STRANDFOAM GROUP (PTY) LTD

ATMOSPHERIC IMPACT REPORT

GAUTENG OPERATIONS - ROSSLYN FACILITY

19 FEBRUARY 2025

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STRANDFOAM GROUP (PTY) LTD

REPORT (VERSION 01)

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ABBREVIATIONS

AEL	Atmospheric Emissions Licence
AIR	Atmospheric Impact Report
API	American Petroleum Industry
C_6H_6	Benzene
$CaCO_3$	Calcium carbonate
CO	Carbon monoxide
DEA	Department of Environmental Affairs
ESL	Effects Screening Level
g/s	Grams per second
mg/Nm³	Milligrams per cubic meter (under normal conditions of 273 Kelvin and 101.3 kPa)
MEC	Methylene chloride
MES	Minimum Emission Standards
MSDS	Material Safety Data Sheets
MW	Megawatt
NAAQS	National ambient air quality standards
NASA	National Aeronautics and Space Administration
NAEIS	National Atmospheric Emission Inventory System
NEM:AQA	National Environmental Management: Air Quality Act 39 of 2004
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
P100	100th percentile
P99	99th percentile
PM	Particulate matter
PM_{10}	Particulate matter less than 10 µm in diameter
$PM_{2.5}$	Particulate matter less than 2.5 µm in diameter
REL	Reference Exposure Level
Rosslyn	Strandfoam Gauteng Operations – Rosslyn Facility
SANAS	South African National Accreditation System

SO_2	Sulphur dioxide
SRTM	Shuttle Radar Topography Mission
Strandfoam	Strandfoam Group (Pty) Ltd
TCEQ	Texas Commission on Environmental Quality
TDI	Toluene di-isocyanate
TVOC	Total volatile organic compounds
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
WHO	World Health Organisation
WSP	WSP Group Africa (Pty) Ltd

EXECUTIVE SUMMARY

Strandfoam (Pty) Ltd (Strandfoam) currently operate a polyurethane foam production facility in Rosslyn, within the City of Tshwane, Gauteng. Primary operations at the Rosslyn facility resulting in atmospheric emissions include bulk storage of liquid raw materials in storage tanks; polyurethane foam production using toluene di-isocyanate (TDI); chipfoam production requiring steam and heat generated by a diesel-fired boiler; and bulk storage of diesel.

The Rosslyn facility manufactures foam using toluene di-isocyanate (TDI) in excess of 100 tons per annum, therefore triggering listed activity Category 6: Organic Chemicals Industry as per Government Notice Regulation 893 of 2013, promulgated in line with Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA). The facility is currently not licensed for the applicable Section 21 listed activity. As such, an Atmospheric Emissions License (AEL) rectification process is required in terms of Section 22A (S22A) of NEM:AQA. Section 22A addresses the conduct of a listed activity without a valid AEL.

WSP Group Africa (Pty) Ltd (WSP) has been appointed by Strandfoam to undertake the Atmospheric Impact Report (AIR) (this report) to assess the potential air quality impacts of the Rosslyn Facility on the surrounding environment.

The study assessed the potential impacts on the ambient air quality associated with site activities using a Level 2 (AERMOD) dispersion modelling assessment. Impacts on the ambient air quality for criteria pollutants regulated by the National Ambient Air Quality Standards (NAAQS), namely sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$) and benzene were simulated. Process relevant speciated volatile organic compounds were also assessed including toluene, xylene, propylene oxide, methylene chloride (MEC), TDI, and total volatile organic compounds (TVOC).

An emissions inventory was developed using emission rate calculators (TANKS 4.0.9d – for tank sources), emission factors, and stack emission test results for input into the dispersion model. Quantified sources include bulk raw material and fuel storage tanks, the diesel-fired chipfoam boilers and the foam production extrusion vents. Simulated pollutant dispersion outputs were compared to the NAAQS or international guidelines (in the absence of local standards) to assess the degree of impact. Key findings are as follows:

- No off-site exceedances of the NAAQS or relevant international guidelines were found across the array of pollutants assessed.
- Peak concentrations occur either within the operational boundary or along the facility's current fenceline. The only exceedance predicted on the fenceline is for the TDI 8-hour concentrations. Concentrations on Strandfoam Rosslyn's eastern fenceline exceed the 8-hour (0.015 $\mu g/m^3$) OEHHA guideline. Concentrations across the fenceline are, however, compliant.
- It is highlighted that the eastern fenceline on which all pollutant peak concentrations occur, is immediately adjacent to the indoor raw material storage and polyurethane foam production building.
- A cumulative assessment using regional background ambient air quality monitoring data has not been offered, as inclusion of any baseline data would essentially double account for emissions from the Strandfoam facility (in the background measurements and the inputted emission rates), as the facility is currently operational.

Based on the findings of this this environmentally conservative AIR, ground-level impacts associated with atmospheric emissions from the facility are assessed to be low and therefore WSP recommends that Strandfoam be awarded their AEL.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

Strandfoam Group (Pty) Ltd (hereafter referred to as Strandfoam) is a polyurethane foam manufacturer that have three manufacturing facilities located in Rosslyn, Gauteng (Strandfoam Bulk); Strand, Western Cape (Strandfoam Cape) and Queensburgh, KwaZulu-Natal (Strandfoam KZN). This report considers the Strandfoam Rosslyn facility (hereafter referred to as Rosslyn) operations only.

The Rosslyn facility manufactures foam using toluene di-isocyanate (TDI) more than 100 tons per annum, therefore triggering listed activity C*ategory 6: Organic Chemicals Industry* as per Government Notice Regulation 893 of 2013, promulgated in line with Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA). The facility is currently not licensed for the applicable Section 21 listed activity.

The Rosslyn facility manufactures foam using toluene di-isocyanate (TDI) in excess of 100 tons per annum, therefore triggering listed activity Category 6: Organic Chemicals Industry as per Government Notice Regulation 893 of 2013, promulgated in line with Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA). The facility is currently not licensed for the applicable Section 21 listed activity. As such, an Atmospheric Emissions License (AEL) rectification process is required in terms of Section 22A (S22A) of NEM:AQA. Section 22A addresses the conduct of a listed activity without a valid AEL.

WSP Group Africa (Pty) Ltd (WSP) has been appointed by Strandfoam to undertake the AIR update (this report) to assess the potential air quality impacts of the Rosslyn Facility on the surrounding environment.

2 ENTERPRISE DETAILS

2.1 ENTERPRISE DETAILS

Table 2-1 provides the enterprise information for Strandfoam with the details of the responsible contact personnel presented in **Table 2-2**.

Table 2-1: Facility Information

Enterprise Name	Strandfoam Group (Pty) Ltd
Trading As	Strandfoam Bulk
Type of Enterprise, e.g. Company/Close Corporation/Trust	Company
Company/Close Corporation/Trust Registration Number (Registration Numbers if Joint Venture)	1997/007963/07
Registered Address	221 Broadlands Road, Strand, Western Cape, 7139
Postal Address	PO Box 13, Strand, 7139
Telephone Number (General)	021 850 7777
Fax Number (General)	021 853 7777
Industry Type/Nature of Trade	Polyurethane foam production
Land Use Zoning as per Town Planning Scheme	Industrial
Land Use Rights if outside Town Planning Scheme	N/A
Designated Priority area (If applicable)	N/A

AEL Reference Number	Pending submission
Air Quality Consultant	WSP Group Africa (Pty) Ltd

Table 2-2: Contact details

Responsible Person	Willem van der Westhuizen
Emission Control Officer	Oostewald Eksteen
Telephone Number	021 850 7777
Cell Phone Number	084 558 9746 (Willem van der Westhuizen)
	081 015 4009 (Oostewald Eksteen)
Fax Number	021 853 7711
E-mail Address	willem@strandfoam.co.za oostewald.eksteen@strandfoam.co.za
After Hours Contact Details	084 558 9746 (Willem van der Westhuizen)

2.2 LOCATION AND EXTENT OF PLANT

The Rosslyn Facility is in the Rosslyn industrial zone within the City of Tshwane, Gauteng. The site occupies 4.43 km^2 (Latitude: 25°37'58"S, Longitude: 28°05'21"E) at an elevation of approximately 1,270 m above mean sea level (**Table 2-3**). A locality map and site layout are presented in **Figure 2-1** and **Figure 2-2** respectively.

Table 2-3: Location and extent of plant

Physical Address of the Plant	Corner of Frans Du Toit and Cor Delfos Street, Rosslyn
Description of Site (Where No Street Address)	N/A
Coordinates of Approximate Centre of Operations	Latitude: 25°37’58”S, Longitude: 28°05’21” E
Extent (hectares)	4.43
Elevation Above Mean Sea Level (m)	1,270
Province	Gauteng
District Municipality	City of Tshwane, Rosslyn
Local Municipality	N/A
Designated Priority Area (If Applicable)	N/A

2.2.1 DESCRIPTION OF SURROUNDING LAND USE

The land use surrounding the Rosslyn facility includes (**Figure 2-1**):

— Various small and large-scale industries within the immediate vicinity of the site, that range from bulk storage facilities, automotive manufacturers to fuel stations.

— Landfill and waste management sites, other industries and shopping centres within the surrounding industrial area.

— Various residential communities located within a 5 km radius (Hartebeeshoek (~430 m southwest of the site), The Orchards (~320 m south of the site), Chantelle (~2,500 m south of the site), Klerksoord AH (~2,570 m east of the site), Clarina (~2,780 m southeast of the site), Karenpark (~2,780 m southeast of the site), Shoshanguve (~2,870 m north of the site), Heatherdale (~3,690 m southeast of the site), Klipfontein (~3,830 m northwest of the site), Hartebeeshoek 303-JR (~3,945 m south of the site) and Fundus AH (~4,200 m southwest of the site)).

— Other amenities (places of worship, shopping centres, schools, educational and recreational facilities) are also located within these surrounding residential areas.

2.2.2 SENSITIVE RECEPTORS

Sensitive receptors, as defined by the United States Environmental Protection Agency (USEPA) include, but are not limited to, hospitals, schools, day-care facilities, elderly housing and convalescent facilities (USEPA, 2023). These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides and other pollutants. Extra care must be considered when dealing with pollutants in proximity to areas recognised as sensitive receptors. In line with this definition the residential, educational, and recreational land in the surrounding area are considered sensitive receptors.

For this study, sensitive receptors were sourced from 1:6,300 digital raster graphic maps and verified during a site visit as well as using Google Earth Pro^{TM}. Identified sensitive receptors are displayed in **Table 2-4** and **Figure 2-3**.

Table 2-4: Sensitive receptors within a 5km radius of the Rosslyn facility

ID	Description	Latitude (°S)	Longitude (°E)	Distance from Site Boundary (km)	Direction from Site
SR1	Fountain of life Church	25.637465	28.084248	0.61	Southwest
SR2	Orchards Residential Area 1	25.640296	28.102841	1.49	East-southeast
SR3	Orchards Primary	25.648043	28.096885	1.64	Southeast
SR4	Orchards Residential Area 2	25.636305	28.088391	0.29	South
SR5	Hartebeeshoek Residential Area 1	25.635367	28.084667	0.42	Southwest
SR6	Hartebeeshoek Residential Area 2	25.632445	28.073157	1.52	West
SR7	Rosslyn Gardens Residential Area	25.621221	28.067081	2.48	Northwest
SR8	Rosslyn Primary	25.625977	28.055987	3.35	West
SR9	Klerksoord AH	25.639951	28.114825	2.59	East
SR10	Klipfontein Residential Area	25.604446	28.059646	4.22	Northwest
SR11	Soshanguve Residential Area 1	25.603104	28.076298	3.39	North-northwest
SR12	Soshanguve Residential Area 2	25.604589	28.088255	2.93	North
SR13	Pele Primary School	25.601676	28.105410	3.57	North-northeast
SR14	Soshanguve Residential Area 3	25.606149	28.097263	2.85	North-northeast

2.3 ATMOSPHERIC EMISSION LICENSE

To continue operating, Strandfoam must compile and submit an AEL application for the Rosslyn Facility in terms of Section 22A of NEM:AQA. The facility manufactures foam using TDI more than 100 tons per annum (922.11 tons per annum), therefore triggers listed activity C*ategory 6: Organic Chemicals Industry* of Government Notice 893 of 2013, promulgated in line with Section 21 of NEM:AQA.

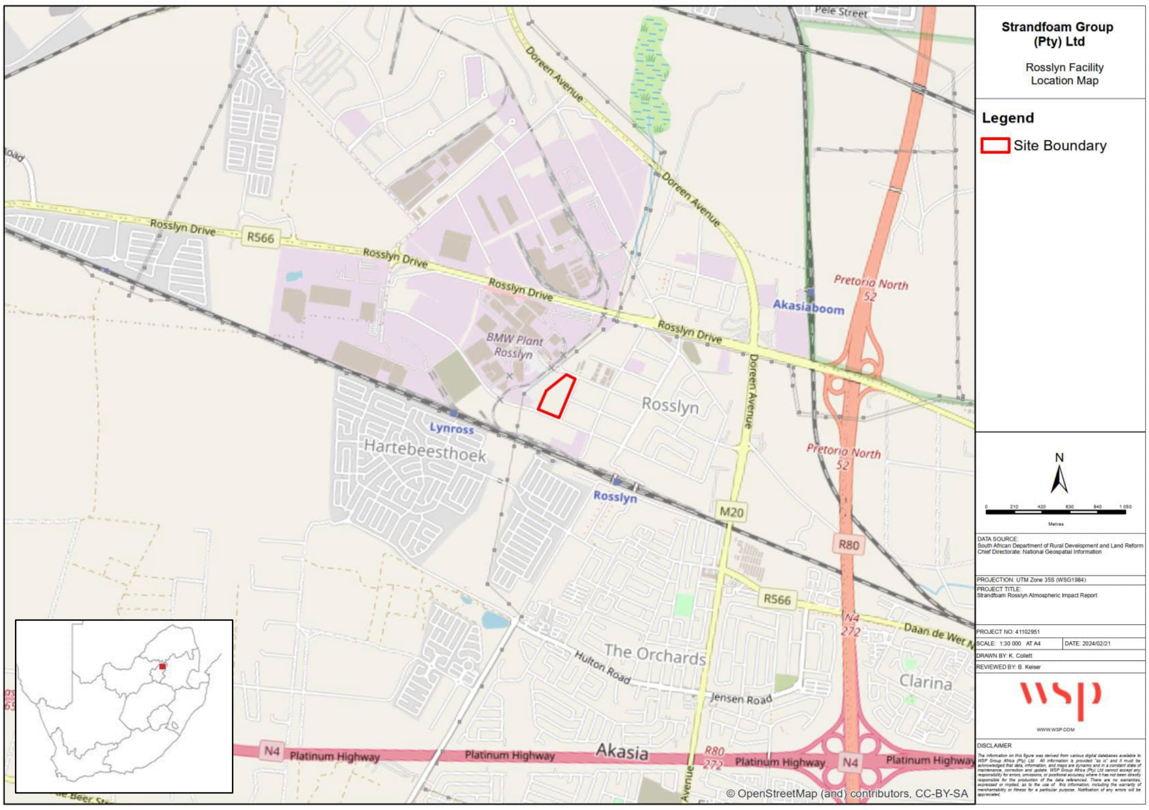


Figure 2-1: Location of the Rosslyn Facility

Figure 2-2: Site layout of the Rosslyn Facility

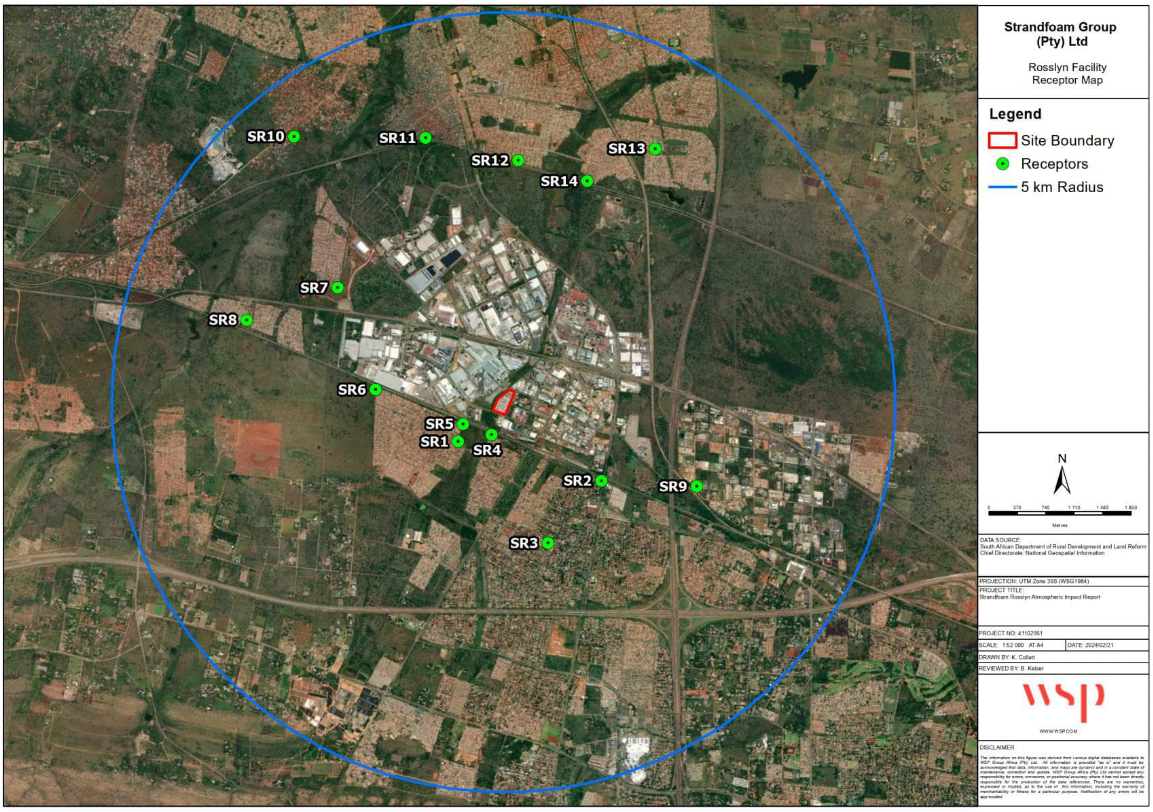


Figure 2-3: Sensitive receptors within a 5 km radius of the Rosslyn Facility

3 NATURE OF THE PROCESS

3.1 LISTED ACTIVITIES

Listed activities and associated minimum emission standards (MES) were published in Government Notice 248, Government Gazette 33064 of 2010, in line with Section 21 of NEM:AQA. An amended list of activities was published in Government Notice 893 of Government Gazette 37054 in 2013, Government Notice 551 of Government Gazette 38863 in 2015 and further in Government Notice 1207 of Government Gazette 42013 in 2018. **Table 3-1** presents the listed activity triggered by the Rosslyn Facility.

Table 3-1: Listed activity applicable to the Rosslyn Facility

Category Of Listed Activity	Subcategory Of Listed Activity	Description of the Listed Activity
6: Organic chemicals industry	N/A	The production or use in production of organic chemicals not specified elsewhere including acetylene, acetic, maleic or phthalic anhydride or their acids, carbon disulphide, pyridine, formaldehyde, acetaldehyde, acrolein and its derivatives, acrylonitrile, amines and synthetic rubber. The production of organometallic compounds, organic dyes and pigments, surface-active agents. The polymerisation or co-polymerisation of any unsaturated hydrocarbons substituted hydrocarbon (including vinyl chloride). The manufacture, recovery or purification of acrylic acid or any ester of acrylic acid. The use of toluene di-isocyanate or other di-isocyanate of comparable volatility; or recovery of pyridine.

3.2 PROCESS DESCRIPTION

A process flow diagram for the Rosslyn Facility is presented in **Figure 3-1**. Process activities are described below:

- Raw materials are received at site in drums, intermediate bulk containers, flexi bags and bulk containers or bags and transferred into bulk storage tanks or enclosed storage areas.
- Materials are blended through metering pumps at pressures of up to 3.5 kPa (depending on the specific blend mixture).
- The blended mixture chemically reacts causing the liquid mixture to expand and solidify into foam, releasing carbon dioxide (CO_2) in the process.
- The foam is cut into blocks that are 1 m high and 1.91 m wide with lengths ranging between 1.37 m and 3.1 m.
- Foam blocks are placed outside for curing for approximately 24 hours before being transferred to storage. The foam blocks are covered in a plastic film to protect them from the elements during curing and storage.
- Foam blocks are dispatched to customers and offcuts are repurposed to form chipfoam blocks.

The Rosslyn facility currently operates a single diesel boiler (0.39 MW)) which generates steam during chipfoam production. Strandfoam plans to install an additional boiler of <10 MW in 2025. Atmospheric emissions expected from site activities include total volatile organic compounds (TVOC), (as regulated by the MES) from chemical storage and foam block production, as well as criteria pollutants, namely sulphur dioxide (SO_2), nitrogen dioxide

(NO_2), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), carbon monoxide (CO) and TVOC from fuel combustion in the boilers.

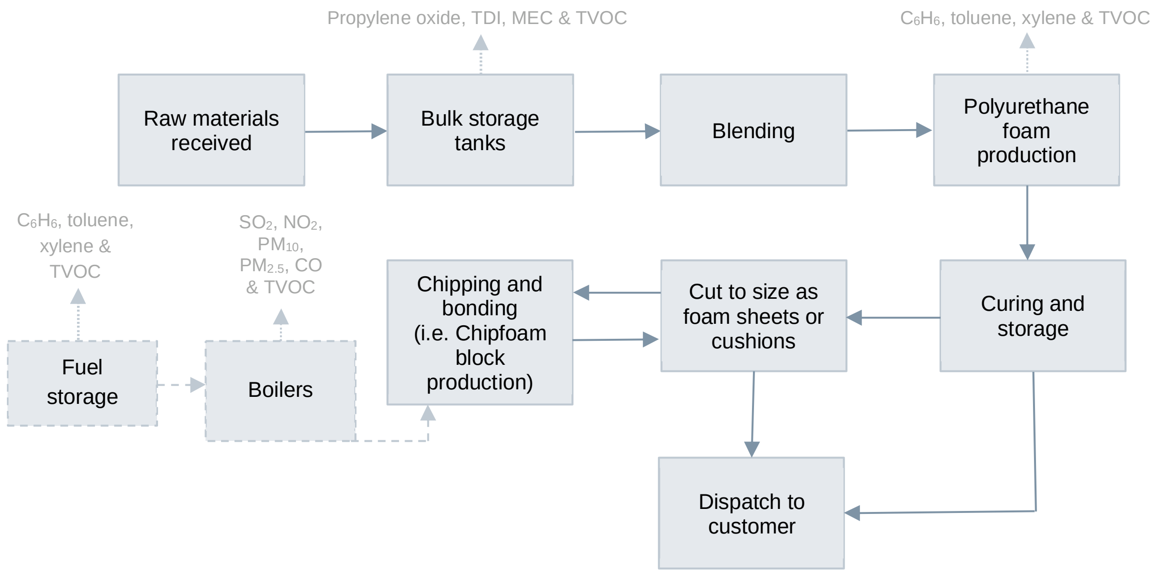


Figure 3-1: Process flow for polyurethane foam block and chipfoam block manufacturing

3.3 UNIT PROCESSES

A summary of the unit processes, function and operational hours at the Rosslyn Facility is provided in **Table 3-2**.

Table 3-2: Unit process and operational times for the Rosslyn Facility

Unit process	Function	Operational hours	Batch/ Continuous
Bulk chemical storage	Bulk storage of various chemicals in above ground tanks	24 hours/ 365 days	Continuous
Polyurethane foam block manufacturing	Manufacturing of polyurethane foam blocks	1 hour/ 153 days	Batch
Chipfoam block production	Chipping and bonding of polyurethane foam offcuts	9.5 hours/ 224 days	Batch
Boilers	Heat / steam generation	9.5 hours/ 224 days	Batch

4 TECHNICAL INFORMATION

4.1 RAW MATERIAL USED

Table 4-1 below provides details on the raw material, products and energy sources used at the facility.

Table 4-1: Raw materials, products and energy sources

Category	Item	Consumption / Production Rate	Unit
Raw materials	Polyol	134,877.41	kg/month
	Toluene diisocyanate (TDI)	76,842.50	kg/month
	Calcium carbonate ($CaCO_3$)	15,112.13	kg/month
	Methylene chloride (MEC)	4886.97	kg/month
Products	Polyurethane blocks (foam blocks)	191	tonnes/month
	Chipfoam blocks	133	tonnes/month
Energy	Diesel - Boiler	6,529.00	litres/month
	Diesel - Vehicles	5,425.17	litres/month
	Petrol – Vehicles	1,864.58	litres/month
	Electricity – Eskom	27.1	MWh/month
	Electricity - Solar	12.9	MWh/month

4.2 APPLIANCES AND ABATEMENT TECHNOLOGY

There are currently no abatement appliances or technology installed at the Rosslyn Facility.

5 ATMOSPHERIC EMISSIONS

An emissions inventory is a list of pollution sources, their physical and chemical parameters, as well as the quantification of emissions. Emissions are calculated using emission factors or mass balance approaches, requiring chemical and activity data inputs. Emissions for the Rosslyn Facility are discussed in detail below. One modelling scenario was conducted for the Rosslyn Facility, where impacts arising from their operational activities were assessed.

5.1 STORAGE TANKS

Volatile Organic Compound (VOC) emissions from storage tanks that contain organic liquids, especially highly volatile liquids, occur because of evaporative losses of the liquid during its storage and because of changes in the liquid level. The emission rates are dependent on the tank design. The two significant types of emissions from tanks are breathing and working losses. Breathing loss is the expulsion of vapour from tanks through vapour expansion and contraction, which is the result of changes in temperature and barometric pressure. This loss occurs without any change in liquid level in the tank. The loss from filling and emptying the tank is called working loss. Emissions during filling operations are due to an increase in the liquid level in the tank. As the liquid level increases, the pressure inside the tank exceeds the relief pressure and vapours are expelled from the tank.

The NEM:AQA Regulations Regarding Air Dispersion Modelling (hereafter referred to as the *Modelling Regulations)* recommends the use of the USEPA and American Petroleum Industry (API) TANKS 4.0.9d model (TANKS) for estimating emissions from bulk liquid storage tanks. TANKS is windows-based software based on the emission estimation procedures from the USEPA's compilation of air pollutant emissions factors (AP-42). TANKS uses chemical, meteorological, roof fitting, rim seal data, tank dimensions and physical parameters (i.e. colour and condition of the shell and roof) to generate breathing and working loss estimates for various types of storage tanks.

The USEPA TANKS 4.0.9d model requires local meteorological input at an annual and monthly resolution. Weather Research and Forecasting Model (WRF) Pre-processed Meteorological data (ambient temperature and wind speed) was sourced from Lakes Environmental Consultants Inc. and the Atmospheric Science Data Centre: NASA GEOS-4 model (solar energy) (NASA, 2023). This data was utilised as it represented the most complete dataset for all required variables. Annual and monthly meteorological variables (in imperial units as required for TANKS input) are presented in **Table 5-1**.

Table 5-1: Meteorological data input for TANKS model calculations

Month	Daily Average Ambient Temperature (F)	68.56	Atmospheric Pressure (PSIA)	12.70
	Daily Maximum Ambient Temperature (F)	Daily Minimum Ambient Temperature (F)	Solar Insulation Factor (Btu/(ft*ft*day))	Average Wind Speed (mph)
January	95.09	56.39	2,020.63	7.10
February	93.11	57.83	2,017.46	6.29
March	90.95	55.67	1,821.85	5.76
April	87.71	52.43	1,518.38	5.68
May	78.71	42.35	1,487.72	4.75
June	75.83	39.83	1,320.65	5.17
July	74.75	37.49	1,425.33	4.91
August	82.85	38.03	1,628.35	6.40
September	90.59	47.57	1,958.25	6.82
October	94.73	51.35	2,034.38	7.68
November	96.89	54.95	1,995.25	7.77
December	94.73	55.67	1,968.82	7.09
Annual Average	88.00	49.13	1,766.42	6.28

There is a broad spectrum of chemicals preloaded into TANKS. In the case of Strandfoam, where raw materials or fuel-based products were not standard to TANKS, Material Safety Data Sheets (MSDS) and online chemical databases were used to determine the chemical composition and chemical properties of each storage component. When there was insufficient information to calculate mixture properties, one of the chemicals preloaded to TANKS (that had similar characteristics to the mixtures) was used as a substitute to imitate the material's emission potential. Chemical mixtures and substitutes input into TANKS for liquid raw materials that would result in VOC emissions are listed in **Table 5-2**. Raw material storage tank specifications and calculated emission rates are provided in **Table 5-3**. Fuel storage tank specifications and calculated emission rates are provided in **Table 5-4**. **Appendix A** presents the simulated tank results.

Table 5-2: Chemical characteristics and substitutes (where applicable) for TANKS model

Source ID	Chemical Name	Chemical Type	Modelled in TANKS as	Chemical properties
EU001 – EU010 and EU012 – EU013 and EU018 – EU019 and EU022 – EU025 and EU033	Polyol	Polymer	Polyol[1] emitted as propylene oxide	Vapour pressure (psia) for each temperature (°F): 40 = 0.116 50 = 0.116 60 = 0.116 70 = 0.116 80 = 0.290 90 = 0.290 100 = 0.290 Molecular weight = 3000 g/mol; Vapour molecular weight = 58.0419 g/mol; Vapour pressure at 20°C = 0.8 kPa
EU014 – EU017	TDI	Organic solvent	Toluene diisocyanate[2]	Vapour pressure (psia) for each temperature (°F): 40 = 0.00005 50 = 0.00008 60 = 0.00015 70 = 0.00024 80 = 0.00041 90 = 0.00068 100 = 0.00102 Molecular weight = 174.16 g/mol; Vapour pressure at 20°C = 1.64 kPa
EU020 – EU021	Methylene Chloride (MEC)	Organochloride	Methylene chloride[3]	Antoine's equation constants (using °C): A: 7.409 B: 1325.9 C: 252.6 Molecular weight = 84.94 g/mol; Vapour pressure at 20°C = 47 kPa
EU026 – EU028	Diesel	Fuel oil	Distillate fuel oil no. 2[4]	Preloaded to TANKS
EU036	Petrol	Fuel Oil	Gasoline RVP 9	Preloaded to TANKS

[1] DOW - Voranol 8322 Polyol MSDS (URL: https://www.dow.com/en-us/pdp.voranol-8322-polyol.401185z.html). Vapour molecular weight for propylene oxide used.
[2] URL: https://dii.americanchemistry.com/TDIMDI-Basics/Nomenclature-and-PhysicalChemical-Properties/PDF-TDI-Mixed-Isomers-Vapor-Pressure-Chart.pdf
[3] URL: https://webbook.nist.gov/cgi/cbook.cgi?ID=C75092&Mask=4&Type=ANTOINE&Plot=on
[4] USEPA AP-42 - Fuel Oil (URL: https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)

Table 5-3: Raw material tank storage and specifications and calculated emission rates

Source ID	GP_01	GP_02	GP_03	GP_04	GP_05	GP_06	GP_07	GP_08	GP_11	GP_12	GP_13	GP_15
Tank EU ID	EU001 - EU006	EU007	EU008 - EU010	EU012 - EU013 & EU029 – EU032	EU014 - EU017	EU018 - EU019	EU020 - EU021	EU022 - EU025	EU011	EU033	EU034	EU037
Chemical Name	Polyol	$CaCO_3$ & Polyol	Polyol	Polyol	TDI	Polyol	MEC	Polyol	Polyol	Melafine & Polyol	Polyol	$CaCO_3$ & Polyol
Number of duplicate tanks	6	1	3	10	4	2	2	4	1	1	1	1
Latitude (°S)	25.632780	25.632780	25.632463	25.632423	25.632732	25.632517	25.632676	25.632696	25.632787	25.632723	25.632748	25.632459
Longitude (°E)	28.089884	28.089884	28.089977	28.090022	28.089758	28.089959	28.089615	28.089848	28.089840	28.089888	28.089883	28.089953
Situation (indoor, underground, etc.)	Indoor	Indoor	Indoor	Outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
Horizontal / Vertical	Horizontal	Horizontal	Vertical	Vertical	Horizontal	Horizontal	Vertical	Vertical	Horizontal	Horizontal	Vertical	Vertical
Floating or fixed roof	N/A	N/A	Fixed roof	Fixed roof	N/A	N/A	Fixed roof	Fixed roof	N/A	N/A	Fixed	N/A
Height / Length (m)	5.43	5.50	4.20	6.00	5.65	5.53	2.40	3.80	3.02	1.90	1.57	1.80
Diameter (m)	2.32	2.32	3.90	3.26	2.24	1.78	1.17	3.00	1.80	1.79	1.54	1.76
Maximum liquid height (m)	2.09	2.09	3.78	5.40	2.02	1.60	2.16	3.42	1.62	1.61	1.41	1.62
Average liquid height (m)	1.04	1.04	1.89	2.70	1.01	0.80	1.08	1.71	0.81	0.81	0.71	0.81
Working volume (m^3)	21.76	22.04	45.16	45.07	25.75	13.04	2.17	24.17	7.29	4.53	2.63	3.94
Turnovers per tank per year	3.00	16.50	3.00	3.00	8.95	3.00	13.50	3.00	N/A[1]	1.00	TBC[2]	N/A[1]
Net throughput per tank (m^3/yr)	65.33	362.69	135.60	135.30	230.53	39.15	29.32	72.60	N/A[1]	4.53	TBC[2]	N/A[1]
Heated?	No	No	No	No	No	No	No	No	No	No	No	No
Colour of tank	Silver	Silver	Grey steel	Silver	Silver	Silver	Grey steel	Silver	Silver	Blue	Blue	Blue
Pressure setting (psig)	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	0.3	Ambient	Ambient	Ambient	Ambient	Ambient
Source type for modelling	Volume	Volume	Volume	Area	Volume	Volume	Volume	Volume	N/A[1]	Volume	TBC[2]	N/A[1]
Calculated emission rate per tank	**kg/annum**											
Total volatile organic compounds (TVOC)	18.27	28.29	49.76	34.56	0.11	11.04	504.85	19.50	-	6.24	-	-
Propylene oxide (C_3H_6O)	18.27	28.29	49.76	34.56	-	11.04	-	19.50	-	6.24	-	-

Source ID	GP_01	GP_02	GP_03	GP_04	GP_05	GP_06	GP_07	GP_08	GP_11	GP_12	GP_13	GP_15
Toluene diisocyanate ($C_9H_6N_2O_2$)	-	-	-	-	0.11	-	-	-	-	-	-	-
Methylene chloride (CH_2Cl_2)	-	-	-	-	-	-	504.85	-	-	-	-	-
Calculated emission rate per group	**kg/annum**											
Total volatile organic compounds (TVOC)	109.60	28.29	149.29	345.64	0.45	22.09	1,009.70	78.02	-	6.24	-	-
Propylene oxide (C_3H_6O)	109.60	28.29	149.29	345.64	-	22.09	-	78.02	-	6.24	-	-
Toluene diisocyanate ($C_9H_6N_2O_2$)	-	-	-	-	0.45	-	-	-	-	-	-	-
Methylene chloride (CH_2Cl_2)	-	-	-	-	-	-	1009.70	-	-	-	-	-
Calculated emission rate per group -for model	**g/s**											
Total volatile organic compounds (TVOC)	3.48E-03	8.97E-04	4.73E-03	1.10E-02	1.44E-05	7.00E-04	3.20E-02	2.47E-03	-	1.98E-04	-	-
Propylene oxide (C_3H_6O)	3.48E-03	8.97E-04	4.73E-03	1.10E-02	-	7.00E-04	-	2.47E-03	-	1.98E-04	-	-
Toluene diisocyanate ($C_9H_6N_2O_2$)	-	-	-	-	1.44E-05	-	-	-	-	-	-	-
Methylene chloride (CH_2Cl_2)	-	-	-	-	-	-	3.20E-02	-	-	-	-	-
Notes:	(1) EU011 and EU037 are process tanks used solely for decanting drums or intermediate bulk containers. Emissions from such are therefore accounted for in the related storage tanks. (2) EU034 is not yet operational, so there is currently no throughput. Additionally, due to the tank's relatively small size compared to other tanks, any potential emissions are expected to be minimal.											

Table 5-4: Fuel storage tank specifications and calculated emission rates

Source ID	GP_09	GP_10	GP_14
Tank EU ID	**EU026 – EU027**	**EU028 & EU035**	**EU036**
Chemical Name	Diesel	Diesel	Petrol
Number of duplicate tanks	2	2	1
Latitude (°S)	25.632807	25.632495	25.632249
Longitude (°E)	28.090117	28.089628	28.089701
Situation (indoor, outdoor, underground)	Underground	Indoor	Outdoor
Horizontal / Vertical	Horizontal	Horizontal	Vertical
Floating or fixed roof	N/A	N/A	N/A
Height / Length (m)	4.46	2.15	2.15
Diameter (m)	2.00	1.15	1.15
Maximum liquid height (m)	N/A	1.04	1.94
Average liquid height (m)	N/A	0.52	0.97
Working volume (m^3)	14.00	2.12	2.01
Turnovers per tank per year	2.30	36.96	11.14
Net throughput per tank (m^3/yr)	32.60	78.35	22.38
Heated?	No	No	No
Colour of tank	N/A	Grey	Grey
Pressure setting	Ambient	Ambient	Ambient
Source type for modelling	Point	Point	Point
Calculated emission rate per tank	**kg/annum**		
Total volatile organic compounds (TVOC)	0.10	0.52	171.44
Benzene (C_6H_6)	0.00	0.00	1.23
Toluene (C_7H_8)	0.00	0.01	1.43
Xylene (C_8H_{10})	0.00	0.03	0.42
Calculated emission rate per group	**kg/annum**		
Total volatile organic compounds (TVOC)	0.21	1.04	171.44
Benzene (C_6H_6)	0.00	0.00	1.23
Toluene (C_7H_8)	0.01	0.03	1.43
Xylene (C_8H_{10})	0.01	0.06	0.42
Calculated emission rate per group – for model	**g/s**		
Total volatile organic compounds (TVOC)	6.62E-06	3.31E-05	5.44E-03
Benzene (C_6H_6)	0.00E+00	0.00E+00	3.90E-05
Toluene (C_7H_8)	2.88E-07	8.63E-07	4.53E-05
Xylene (C_8H_{10})	2.88E-07	2.01E-06	1.32E-05

5.2 EXTRUSION VENTS

Emissions resulting from the production of foam are exhausted through extrusion vents located on the rooftop of the building in which the process occurs. Emission rates were calculated using the latest stack emission test results, conducted by Skyside between 06 and 20 September 2022, refer to **Appendix B** for the full stack test report. Compounds detected in the flue gas streams which include benzene, toluene and xylene have been quantified. Trace amounts of other compounds detected are accounted for as TVOC and not individually quantified. Point source specifications, measured concentrations and calculated emission rates are provided in **Table 5-5**.

Table 5-5: Point source parameters and emission rates for extrusion vents

Source ID	Extrusion Vent – Front	Extrusion Vent – Back
Latitude (°S)	25.632630	25.632659
Longitude (°S)	28.089370	28.089476
Stack height (m)	7.80	7.80
Stack diameter (m)	0.72	0.72
Gas exit velocity (m/s)	7.20	8.90
Gas exit temperature (°C)	23.00	23.00
Flow rate (Nm^3/s)	2.92	3.25
Operating period (hr/year)	153	153
Emission rate (mg/Nm^3)		
TVOC	7.00E-02	1.00E-01
Benzene	6.50E-03	8.50E-03
Toluene	3.70E-02	6.34E-02
Xylene	9.20E-03	1.52E-02
Emission rates (g/s)		
TVOCs	1.62E-04	2.58E-04
Benzene	1.51E-05	2.19E-05
Toluene	8.57E-05	1.64E-04
Xylene	2.13E-05	3.92E-05

5.3 CHIPFOAM BOILER

The Rosslyn facility currently operates a single chipfoam boiler (0.39 MW heat input) which is used for the generation of steam during chipfoam production. Strandfoam plans to install an additional boiler of <10 MW in 2025. With the addition of the new boiler (Boiler 2 – Chipfoam 3) the cumulative heat input of all boilers will be < 10MW. As such, both boilers are included in this assessment in order to obtain the most conservative emissions profile for the facility. It is, however, also noted that the additional boiler will not be used to increase the production throughput at the facility, but to reduce the load on the existing boiler. As such, the current diesel usage will remain the same and be split equally between the two boiler units.

The National Atmospheric Emissions Inventory System (NAEIS) guidelines provides a methodology for calculating atmospheric emissions in the absence of emission monitoring data. **Table 5-6** provides emission factors used for small combustion sources with a design capacity less than 10 MW.

Table 5-6: NAEIS emission factors for small combustion sources

Pollutant	Emission Factor (kg/t)
Oxides of nitrogen (NO_X)	4.3
Sulphur dioxide (SO_2)	6.02
Particulate matter (PM_{10})	0.9245
Particulate matter ($PM_{2.5}$)	0.7095
Total volatile organic compounds (TVOCs)	0.43
Carbon monoxide (CO)	1.72

Table 5-7 provides the parameters and calculated emission rates for the Chipfoam boiler.

Table 5-7: Chipfoam boiler parameters and emission rates

Source ID	Boiler 1 – Chipfoam 1& 2	Boiler 2 – Chipfoam 3
Latitude (°S)	25.632489	25.632489
Longitude (°E)	28.089664	28.089664
Stack height (m)	8.6	7.8
Stack diameter (m)	0.25	0.25
Gas exit velocity (m/s)	8.05	8.05
Gas exit temperature (°C)	225	250
Consumption rate (litres/year)	39174	39174
Operating period (hr/year)	2,125	2,125
Pollutant	**Calculated Emission rates (g/s)**	
TVOCs	1.85E-03	1.85E-03
NO_X	2.59E-02	2.59E-02
SO_2	1.85E-02	1.85E-02
PM_{10}	7.40E-03	7.40E-03
$PM_{2.5}$	3.98E-03	3.98E-03
CO	3.05E-03	3.05E-03

5.4 EMERGENCY INCIDENTS

As confirmed by Strandfoam, there were fires at the facility on 10 August 2024 (lasting two hours) and 24 January 2025 (lasting 1.5 hours).

The fire on 10 August 2024 resulted from a veld fire that ignited waste products along the northwestern boundary of Strandfoam's fence. Four storage containers containing polyurethane foam offcuts caught fire due to the wind direction. This led to a section of a building burning down; however, the internal fire wall limited the damage to a single compartment of the building.

The fire on 24 January 2025 destroyed the canopy and sections of adjacent buildings up to the fire walls.

According to Strandfoam, both incidents were reported to the licensing authority.

6 IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT

6.1 ANALYSIS OF EMISSIONS ON HUMAN HEALTH

6.1.1 REGULATORY FRAMEWORK FOR AIR QUALITY

Until 2004, South Africa's approach to air pollution control was driven by the Atmospheric Pollution Prevention Act 45 of 1965 (APPA) which was repealed with the promulgation of NEM:AQA. NEM:AQA represents a shift in South Africa's approach to air quality management, from source-based control to integrated effects-based management. The objectives of NEM:AQA are to:

- Protect the environment by providing reasonable measures for:
  - The protection and enhancement of air quality.
  - The prevention of air pollution and ecological degradation.
  - Securing ecologically sustainable development while promoting justifiable economic and social development.
  - Give effect to everyone's right "to an environment that is not harmful to their health and well-being".

Significant functions detailed in NEM:AQA include:

- The National Framework for Air Quality Management (DEA, 2018).
- Institutional planning matters, including:
  - The establishment of a National Air Quality Advisory Committee.
  - The appointment of Air Quality Officers (AQOs) at each level of government.
  - The development, implementation and reporting of Air Quality Management Plans (AQMP) at national, provincial and municipal levels.
- Air quality management measures including:
  - The declaration of Priority Areas where ambient air quality standards are being, or may be, exceeded;
  - The listing of activities that result in atmospheric emissions and which have the potential to impact negatively on the environment and the licensing thereof through an Atmospheric Emissions License (AEL).
  - The declaration of Controlled Emitters.

- The declaration of Controlled Fuels.
- Procedures to enforce Pollution Prevention Plans or Atmospheric Impact Reporting for the control and inventory of atmospheric pollutants of concern.
- Requirements for addressing dust and offensive odours.

LISTED ACTIVITIES AND MINIMUM EMISSIONS STANDARDS

The Rosslyn facility manufactures flexible foam using toluene TDI more than 100 tons per annum, triggering listed activity C*ategory 6: Organic Chemicals Industry* of Government Notice Regulation 893 of 2013 with associated MES presented in **Table 6-1**.

Table 6-1: Minimum Emission Standards and special arrangements for Category 6 - Organic Chemicals Industry

Description	The production, or use in production, of organic chemicals not specified elsewhere, including acetylene, acetic, maleic or phthalic anhydride or their acids, carbon disulphide, pyridine, formaldehyde, acetaldehyde, acrolein and its derivatives, acrylonitrile, amines and synthetic rubber. The production of organometallic compounds, organic dyes and pigments, surface active agents. The polymerisation or co-polymerisation of any unsaturated hydrocarbons, substituted hydrocarbon (including vinyl chloride). The manufacture, recovery or purification of acrylic acid or any ester of acrylic acid. The use of toluene di-isocyanate or other di-isocyanate of comparable volatility; or recovery of pyridine.
Applications	All installations producing or using more than 100 tons per annum of any of the listed compounds.

Substance or mixture of substances		**Plant status**	**mg/Nm^3 under normal conditions of 10% O_2, 273 Kelvin and 101.3 kPa**
Common name	**Chemical symbol**		
Sulphur trioxide (from sulphonation processes)	SO_3	New	30
		Existing	100
Acrylonitrile (from processes producing and/or using acrylonitrile)	CH_2CHCN	New	5
		Existing	5
Methylamines (from nitrogen – containing organic chemicals)	CH_5N	New	10
		Existing	10
Total volatile organic compounds (thermal)	N/A	New	150
		Existing	150
Total volatile organic compounds (non-thermal)	N/A	New	40,000
		Existing	40,000

(a) The following transitional arrangement shall apply for the storage and handling of raw materials, intermediate and final products with a vapour pressure greater than 14 kPa at operating temperature: -
Leak detection and repair (LDAR) program approved by licensing authority to be instituted, by 01 January 2014.

(b) The following special arrangements shall apply for control of TVOCs from the storage of raw materials, intermediate and final products with a vapour pressure of up to 14 kPa at operating temperature, except during loading and offloading. (Alternative control measures that can achieve the same or better results may be used) –
(i) Storage vessels for liquids shall be of the following type:

Application	All permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1000 cubic metres.
True vapour pressure of contents at product storage temperature	Type of tank or vessel
Type 1: Up to 14 kPa	Fixed-roof tank vented to atmosphere, or as Type 2 and 3
Type 2: Above 14 kPa	Fixed–roof tank with Pressure Vacuum Vents fitted as a minimum, to prevent "breathing" losses, or as Type 3
Type 3: Above 14 kPa and up to 91 kPa with a throughput greater than 50 000 m^3 per annum	external floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20 m or

	fixed-roof tank with internal floating deck/roof fitted with primary seal, or fixed-roof tank with vapour recovery system.
Type 4: Above 91 kPa	Pressure vessel

(ii) The roof legs, slotted pipes and/or dipping well on floating roof tanks (except for domed floating roof tanks or internal floating roof tanks) shall have sleeves fitted to minimise emissions.

(iii) Relief valves on pressurised storage should undergo periodic checks for internal leaks. This can be carried out using portable acoustic monitors or if venting to atmosphere with an accessible open end, tested with a hydrocarbon analyser as part of an LDAR programme.

(c) The following special arrangements shall apply for control of TVOCs from the loading and unloading (excluding ships) of raw materials, intermediate and final products with a vapour pressure of greater than 14 kPa at handling temperature. Alternative control measures that can achieve the same or better results may be used:

(i) All installations with a throughput of greater than 50 000m^3 per annum of products with a vapour pressure greater than 14 kPa, must be fitted with vapour recovery destruction units. Emission limits are set out in the table below -

Description	Vapour Recovery Units		
Application	All loading/offloading facilities with a throughput greater than 50 000 m^3		

Substance or mixture of substances		**Plant status**	**mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa.**
Common name	**Chemical symbol**		
Total volatile organic compounds from vapour recovery/destruction units using thermal treatment.	N/A	New	150
		Existing	150
Total volatile organic compounds from vapour recovery/destruction units using non thermal treatment	N/A	New	40 000
		Existing	40 000

(ii) For road tanker and rail car loading/offloading facilities where the throughput is less than 50 000 m^3 per annum, and where ambient air quality is, or is likely to be impacted, all liquid products shall be located using bottom loading, or equivalent, with the venting pipe connected to a vapour balancing system. Where vapour balancing and/or bottom loading is not possible, a recovery system utilizing adsorption, condensation or incineration of the remaining VOCs, with a collection efficiency of at least 95%, shall be fitted.

SOUTH AFRICAN AMBIENT AIR QUALITY STANDARDS

Ambient air quality standards are defined as "*targets for air quality management which establish the permissible concentration of a particular substance in, or property of, discharges to air, based on what a particular receiving environment can tolerate without significant deterioration*" (DEA, 2000). The aim of these standards is to provide a benchmark for air quality management and governance. South Africa's National Ambient Air Quality Standards (NAAQS) are based primarily on guidance offered by two standards set by the South African National Standards (SANS):

— SANS 69:2004 Framework for implementing National ambient air quality standards.
— SANS 1929:2005 Ambient air quality – Limits for common pollutants.

SANS 69:2004 makes provision for the establishment of air quality objectives for the protection of human health and the environment as a whole. Such air quality objectives include limit values, alert thresholds and target values.

SANS 1929:2005 uses the provisions in SANS 69:2004 to establish air quality objectives for the protection of human health and the environment and stipulates that limit values are initially set to protect human health. The setting of such limit values represents the first step in a process to manage air quality and initiate a process to ultimately achieve acceptable air quality nationally.

The priority pollutants as defined by the NEM:AQA are SO_2, NO_2, PM_{10}, $PM_{2.5}$, benzene, CO, Ozone (O_3) and Lead (Pb). Pollutants assessed in this study are TVOCs, SO_2, NO_2, PM_{10}, $PM_{2.5}$ and CO. The NAAQS presented in **Table 6-2** were promulgated in 2009 and 2012. The NAAQS generally have specific averaging periods, compliance timeframes, permissible frequencies of exceedance and measurement reference methods.

Table 6-2: National Ambient Air Quality Standards

Pollutant	Averaging Period	Concentration (µg/m³)	Frequency of Exceedance	Compliance Date
PM_{10}	24-hour	120	4	Immediate – 31 Dec 2014
		75	4	01 Jan 2015
	1 year	50	0	Immediate – 31 Dec 2014
		40	0	01 Jan 2015
$PM_{2.5}$	24-hour	65	4	Immediate – 31 Dec 2015
		40	4	01 Jan 2016 – 31 Dec 2029
		25	4	01 Jan 2030
	1 year	25	0	Immediate – 31 Dec 2015
		20	0	01 Jan 2016 – 31 Dec 2029
		15	0	01 Jan 2030
SO_2	10 minutes	500	526	Immediate
	1-hour	350	88	Immediate
	24-hour	125	4	Immediate
	1 year	50	0	Immediate
NO_2	1-hour	200	88	Immediate
	1 year	40	0	Immediate
CO	1-hour	30,000	88	Immediate
	8-hour	10,000	11	Immediate
O_3	8-hour	120	11	Immediate
Pb	1 year	0.5	0	Immediate

CRITERIA FOR HYDROCARBON EXPOSURE

TVOCs is the term used for a class of several hundred carbon-based chemical compounds that evaporate easily into air. Some VOCs have no known human health effects while the toxicity and carcinogenicity of others is well established. Little is known about how VOCs combine in the atmosphere or what the potential cumulative impacts might be on the human body, making analysis, risk assessment and guideline setting difficult.

No local standards or international guidelines have been set for the assessment of cumulative ambient TVOCs concentrations. Benzene is the only VOC with an established NAAQS in South Africa. Given this, only the benzene portion of TVOCs have been assessed.

INTERNATIONAL GUIDELINES

In the absence of local standards for specific compounds, international guidance is provided. A summary of the guidelines for health impact from exposure to process relevant pollutants (not regulated by NAAQS) is provided in **Table 6-3**.

WORLD HEALTH ORGANISATION

The World Health Organisation (WHO) provide guidelines for protecting public health from the adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. The guidelines are based on expert evaluation of current scientific evidence and are intended to inform policy makers and to provide targets for air quality management. In establishing pollutant levels below which exposure does not constitute a significant public health risk over a specified period of time, the guidelines provide a basis for setting standards or limit values for air pollutants. In general, the guidelines address single pollutants (identified to be of special environmental and health significance to countries of the

European Region) whereas in reality, exposure to mixtures of chemicals occurs, with potentially additive, synergistic or antagonistic effects. In dealing with practical situations or standard-setting procedures, therefore, consideration should be given to the interrelationships between the various air pollutants. In setting legally binding standards, considerations such as prevailing exposure levels, technical feasibility, source control measures, abatement strategies, and social, economic and cultural conditions also should be taken into account (WHO, 2000, 2005, 2021).

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The Texas Commission on Environmental Quality (TCEQ) is the environmental agency for the state of Texas in the United States. TCEQ have developed Effects Screening Levels (ESLs) to evaluate impacts from pollutant concentrations predicted by dispersion modelling simulations. ESLs, which include both short- (1-hour) and long-term (annual) limit values, are chemical-specific concentration limits set to protect human health and welfare. They are not ambient air quality standards but rather a guideline as to whether airborne contaminants present adverse risk. Short-term ESLs are based on data concerning acute health effects, the potential for nuisance odour and effects on vegetation, while long-term ESLs are based on data concerning chronic health and vegetation effects. Welfare ESLs (i.e. odour and vegetation effects) are based on effect thresholds while health ESLs are based on toxicity factors and dose responses relevant to humans (TCEQ, 2006).

CALIFORNIA OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

The California Office of Environmental Health Hazard Assessment (OEHHA) is the lead agency for the assessment of health risks posed by environmental contaminants in the state of California, United States. OEHHA have developed risk assessment guidelines with defined reference exposure levels (RELs) for airborne contaminants. An REL is the concentration level at or below which no adverse non-cancer health effects are anticipated for the specified exposure duration (i.e. acute 1-hour and chronic annual exposure). RELs are designed to protect the most sensitive individuals in the population by the inclusion of factors that account for uncertainties as well as individual differences in human susceptibility to chemical exposures. The factors used err on the side of public health protection to avoid underestimation of non-cancer hazards and as such, exceeding the REL does not automatically indicate an adverse health impact. Increasing concentrations above the REL value increases the likelihood that the health effect will occur (OEHHA, 2015).

Table 6-3: International guidelines for process relevant VOCs

Pollutant	Averaging Period	WHO	TCEQ ESL	OEHHA REL
		μg/m³		
Benzene	1-hour	-	170	27
	8-hour	-	-	3
	1-year	0*	4.5	3**
Toluene	1-hour	-	4,500	5,000
	8-hour	-	-	830
	1-week	260	-	-
	1-year	-	1,200	420
Xylene	1-hour	-	2,200	22,000
	1-year	-	180	700
Methylene chloride	1-hour	-	3,600	14,000
	1-year	-	350	400
Toluene diisocyanate	1-hour	-	0.7	2

Pollutant	Averaging Period	WHO	TCEQ ESL	OEHHA REL
		µg/m³		
	8-hour	-	-	0.015
	1-year	-	0.1	0.008
Propylene oxide	1-hour	-	1,000	3,100
	1 year	-	100	30

Notes:

***** Benzene is carcinogenic to humans and no safe levels of exposure can be recommended by the World Health Organisation. The continuous exposure concentrations of airborne benzene associated with an excess lifetime risk of 1:10 000 for leukaemia is 11.165 µg/m³

The most stringent of the guideline values (red) recommended by the international bodies referenced above, are used in this study to assess impact (with the exception of the WHO benzene threshold **, since benzene is regulated by the NAAQS).

6.1.2 HEALTH IMPACTS ASSOCIATED WITH NATIONALLY REGULATED AIR POLLUTANTS

The composition of air pollutant mixtures, pollutant concentrations, duration of exposure and other susceptibility factors (e.g. age, nutritional status and predisposing conditions) can lead to diverse impacts on human health. Health effects can range from nausea and skin irritation to cancer and mortality (Kampa and Castanas, 2007) (**Table 6-4**). High risk individuals include the elderly, people with pre-existing heart or lung disease, pregnant women, asthmatics and children.

Table 6-4: NAAQS regulated air pollutants and associated human health impacts

Pollutant	Description	Health effects
Sulphur dioxide (SO_2)	SO_2 originates from the combustion of sulphur-rich fuels (principally coal and heavy oils) and the smelting of sulphur-containing ores (Kampa and Castanas, 2007). Health effects associated with exposure to SO_2 are associated with the respiratory system (Maroni *et al.*, 1995).	— Nose and throat irritation — Bronchoconstriction and dyspnoea — Reduced lung function in sensitive individuals
Nitrogen dioxide (NO_2)	Nitric Oxide (NO) is a primary pollutant emitted from combustion processes including stationary sources (e.g. heating, power generation, etc.) and from motor vehicles. Nitrogen dioxide (NO_2) is formed through the oxidation of nitric oxide. Oxidation of NO by O_3 occurs rapidly, even at low levels of reactants present in the atmosphere. NO_x contributes to the formation of tropospheric ozone, an important atmospheric oxidant, a respiratory irritant and a greenhouse gas (WHO, 2000).	— Nose and throat irritation — Bronchoconstriction and dyspnoea — Asthma — Bronchitis — Reduced lung function and tissue damage in sensitive individuals — Emphysema — Premature death
Ozone (O_3)	O_3 in the atmosphere is a secondary pollutant formed through a complex series of photochemical reactions between NO_2 and VOCs in the presence of sunlight. Sources of these precursor pollutants include motor vehicles and industries. Atmospheric background concentrations are derived from both natural and anthropogenic sources. Natural concentrations of O_3 vary with altitude and seasonal variations (i.e. summer conditions favour O_3 formation due to increased insolation). Ozone is a powerful oxidant and can react with a wide range of cellular components and biological materials (WHO, 2000).	— Reduced lung function — Inflammation of the lungs — Pulmonary function decrements — Asthma — Exacerbated pre-existing lung conditions
Particulate matter (PM_{10} & $PM_{2.5}$)	Particles can be classified by their aerodynamic properties into coarse particles, PM_{10} (particulate matter with an aerodynamic diameter of less than 10 µm) and fine particles, $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than 2.5 µm) (Harrison and Grieken, 1998). Particulate air pollution affects the respiratory system (WHO, 2000). Particle size is important for health because it controls how far into the respiratory system particles are able to permeate. Fine particles have been found to be more damaging to human health than coarse particles as larger particles are less respirable in that they do not pass from the lungs into the bloodstream (Manahan, 1991).	— Increase in lower respiratory symptoms — Reduced lung function — Inflammation of the lungs — Angina — Myocardial infraction — Bronchitis — Mortality

Pollutant	Description	Health effects
Carbon monoxide (CO)	CO is one of the most common and widely distributed air pollutants. It is a tasteless, odourless and colourless gas which has a low solubility in water. In the human body, after reaching the lungs it diffuses rapidly across the alveolar and capillary membranes and binds reversibly with haemoglobin, reducing the oxygen carrying capacity of the blood leading to hypoxia as vital organs (particularly the brain and heart) are starved of oxygen. High risk individuals include persons with pre-existing cardiovascular diseases, pregnant women and infants (Kampa and Castanas, 2007). Anthropogenic emissions of CO originate from the incomplete combustion of carbonaceous materials. The largest proportion of these emissions is produced from exhausts of internal combustion engines, in particular petrol vehicles. Other sources include industrial processes, coal power plants and waste incinerators. Ambient CO concentrations in urban areas depend on the density of vehicles and are influenced by topography and weather conditions (Rudolph, 1994).	— Headaches — Nausea and vomiting — Muscle weakness — Shortness of breath — Impaired cognitive ability — Impaired coordination and reflex responses — Haematological problems — Unconsciousness — Mortality
Lead (Pb)	Lead is a naturally occurring heavy metal that is found in the earth's crust. Lead can be released into the atmosphere through volcanic eruptions, sea spray and bushfires. Ore mining and metal processing are the largest anthropogenic sources of lead emissions (Australian Government, 2021). Leaded petrol was once a significant source of lead in urban areas, however, as a result of national legislation, lead has been phased out of petrol and significant reductions in airborne lead have been achieved.	— Muscle pain — Abdominal pain — Headaches — Nausea and Vomiting — Seizures — Coma — Learning disabilities — Impaired coordination — Increased blood pressure — Anaemia — Neuropathies: — Memory disturbances — Sleep disorders — Anger — Fatigue — Tremors — Blurred vision — Miscarriage — Premature delivery or stillbirth
Benzene (C_6H_6)	Benzene is a colourless liquid with an aromatic odour. Crude oil is the largest natural source of benzene. Benzene is used in many products, including plastics, synthetic rubber, glues, paints, furniture wax, lubricants, dyes, detergents, pesticides and some pharmaceuticals. Benzene is emitted from motor engines, wood combustion and stationary fossil fuel combustion. The major source is exhaust emissions and evaporation losses from motor vehicles, and evaporation losses during the handling, distribution and storage of petrol (USEPA, 2012).	— Drowsiness — Dizziness — Headaches — Irritation of the eyes, skin and respiratory tract — Visual disorders — Fatigue — Impaired coordination — Haematological problems — Adverse foetal development — Cancer — Mortality
Total Volatile Organic Compounds (TVOC)	TVOC refers to a class of several hundred carbon based chemical compounds that easily vaporize from the solid or liquid phase into a gas. Some VOCs have little to no known human health effects while others are extremely toxic and potentially carcinogenic. Little is known about how VOCs combine in the atmosphere or what the potential cumulative impacts might be on the human body, making analysis, risk assessment and guideline setting for these collective compounds exceptionally difficult.	— Eye, nose and throat irritation — Headaches — Nausea — Dizziness — Fatigue — Dermal irritation — Damage to the kidneys, liver and central nervous system — Loss of coordination — Cancer — Mortality

6.1.3 METEOROLOGICAL OVERVIEW

Since meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, the incorporation of reliable data into an air quality assessment is of the utmost importance. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the atmospheric mixing layer control the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as the plume 'stretches'. Mechanical turbulence is influenced by wind speed in combination with surface roughness.

Parameters that need to be considered in the characterisation of dispersion potential include wind speed, wind direction, atmospheric stability, ambient air temperature and mixing depth. To accurately represent meteorological conditions occurring at Rosslyn, WRF Pre-processed Meteorological data was purchased from Lakes Environmental Consultants Inc. for the January 2020 – December 2022 monitoring period. The data coverage is centred over the Rosslyn facility (25.0632325°S, 28.089556°E) with a grid cell dimension of 12 km x 12 km resolution over a 50 km x 50 km domain and at an elevation of 1,289 m.

Additionally, temperature and rainfall data for the January 2020 to December 2022 period was sourced from the South African Air Quality Information System (SAAQIS) Rosslyn NAQI (National Air Quality Indicator) station (25.625126°S, 28.09474°E), owned and operated by the City of Tshwane Metropolitan Municipality. Given the proximity of the NAQI station to the Rosslyn Facility (~0.79 km northeast), measured meteorological conditions are considered representative of conditions experienced at the Rosslyn Facility.

The closest South African Weather Services station with respectable data recovery (>90%) is located approximately 40 km from the site. Due to the distance from the Rosslyn facility, the data is considered non-representative of conditions experienced on site and has been excluded from this study.

The percentage data recovery for each meteorological variable is provided in **Table 6-5**. It must be noted that the South African National Accreditation System (SANAS, 2012) TR 07-03 standards stipulate a minimum data recovery of 90% for the dataset to be deemed representative of conditions during a specific reporting period. The percentage recovery for parameters recorded exceeded 90% and is thus considered reliable for use in this assessment.

Table 6-5: Percentage data recovery for the January 2020 – December 2022 monitoring period

Data Source	Latitude (°S)	Longitude (°E)	Data Recovery		
			Temperature	Rainfall	Wind
WRF	25.063232	28.08955	100%	100%	100%
SAAQIS Rosslyn NAQI	25.625126	28.09474	97.0%	0%	94.7%

TEMPERATURE AND RAINFALL

Ambient air temperature influences plume buoyancy as the higher the plume temperature is above the ambient air temperature, the higher the plume will rise. Further, the rate of change of atmospheric temperature with height influences vertical stability (i.e. mixing or inversion layers). Rainfall is an effective removal mechanism of atmospheric pollutants.

Figure 6-1 illustrates the average monthly relative humidity, temperature, temperature range (maximum and minimum) from the Rosslyn NAQI station for the period of 2020 to 2022. Given that rainfall data was not available from the Rosslyn NAQI Station, rainfall data from the WRF dataset has been included in the figure. Strandfoam Rosslyn receives on average 226.30 mm of rainfall per year, with high rainfall occurring during the spring and summer months (September to February) with drier conditions during the winter months (June to August). The highest recorded temperature was 36.87°C (November 2020) while the lowest recorded temperature was 1.83°C (June 2020). Summer temperatures average at 23.04°C while winter temperatures average at 13.80°C.

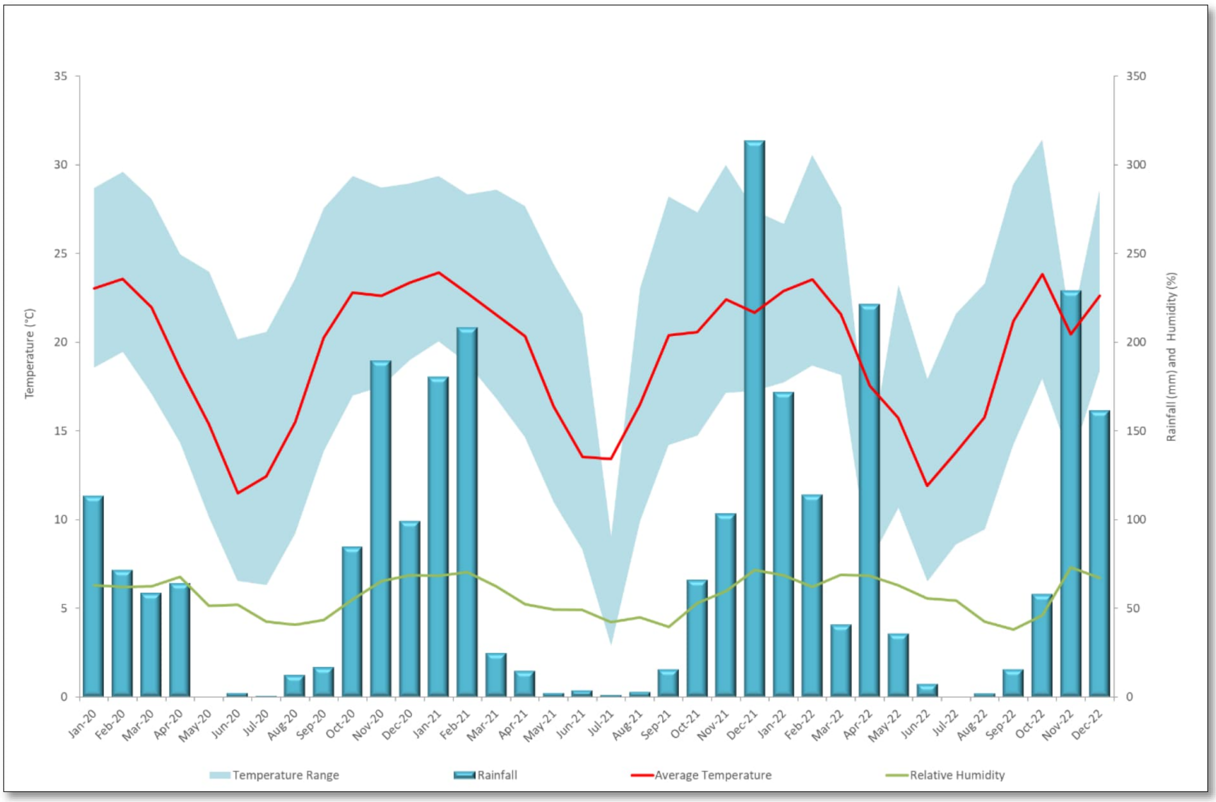


Figure 6-1: Temperature range, average monthly temperature and average relative humidity from the Rosslyn NAQI Station and average rainfall from the WRF meteorological data for the January 2020 to December 2022 period

WIND FIELD

Wind roses are useful for illustrating the prevailing meteorological conditions of an area, indicating wind speeds and directional frequency distributions. In the following wind roses, the colour of the bar indicates the wind speed while the length of the bar represents the frequency of winds *blowing from* a certain direction (as a percentage).

Period wind rose plots (2020-2022) from the Rosslyn NAQI station and WRF modelled data are presented in **Figure 6-2**. The data plots for both datasets exhibit similar conditions. In the case of the WRF data, prevailing winds are from the northeast and east-northeast, with calm wind conditions occurring 6.93% of the time. In the Rosslyn NAQI dataset, the dominant wind directions are from the east-northeast and east, with a much higher occurrence of calm conditions (32.48%) . Wind speeds in the WRF dataset are a lot stronger than those recorded by the Rosslyn NAQI station. Average recorded wind speeds are, however, similar for both datasets with an average speed of 2.76 m/s for the WRF model data and 2.06 m/s for the Rosslyn NAQI data.

Modelled WRF Meteorological data	Rosslyn NAQI Meteorological Data

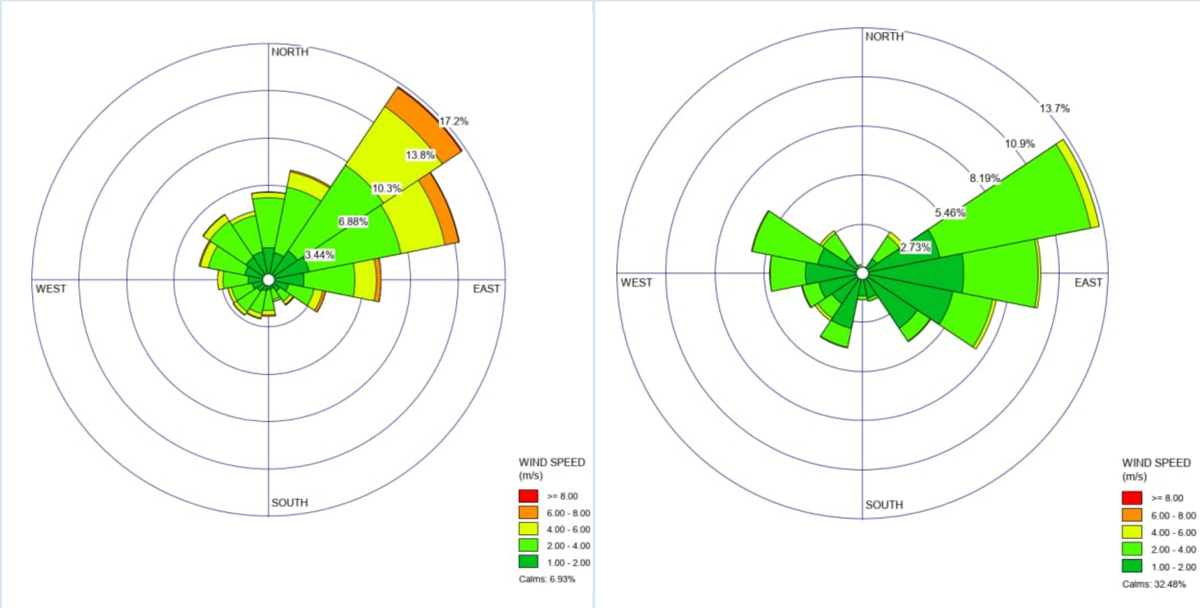


Figure 6-2: Wind rose plots for WRF and Rosslyn NAQI meteorological data for the period January 2020 to December 2022

Seasonal variations in wind are depicted in **Figure 6-3**. During summer (December to February), winds originate predominantly from the northeast, east-northeast and east. The strongest winds are recorded during this time. During autumn (March to May), the north-easterly, east-north-easterly and easterly winds continue to dominate in both datasets, however, wind speeds from these directions occur with a higher frequency and strength in the WRF dataset. At this time, a westerly and south-westerly wind component is also introduced. During winter (June to August) the north-easterly, east-north-easterly and easterly winds continue to dominate, once again with a higher frequency and speed in the WRF dataset. The winds from the westerly and south-westerly quadrants remain and increase slightly in frequency and strength. During spring, the winds from the south-west diminish and winds from the northeast and east-northeast dominate once again.

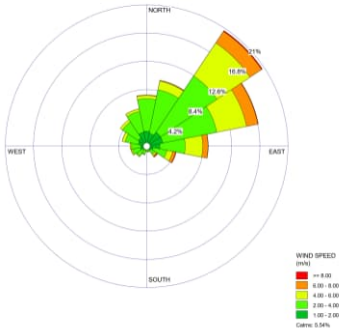
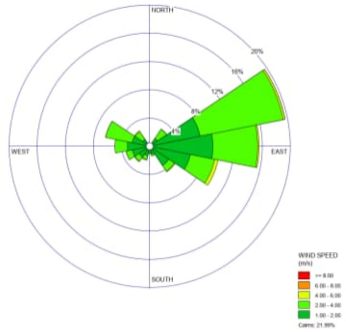
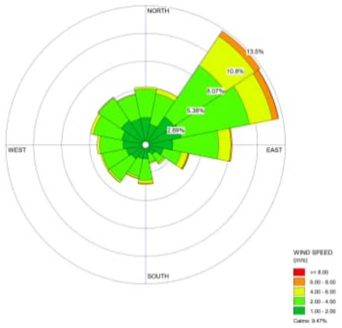
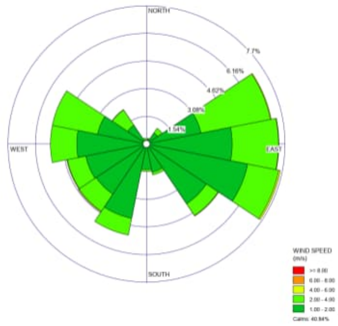
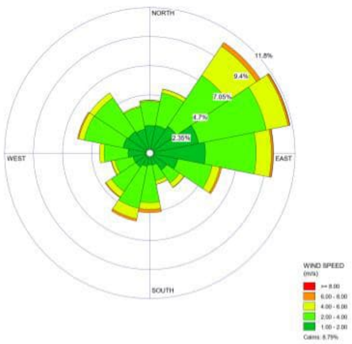
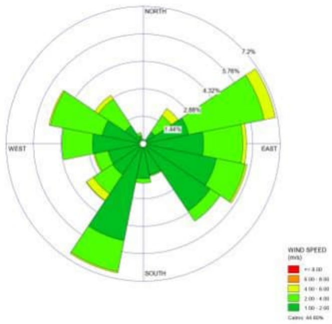
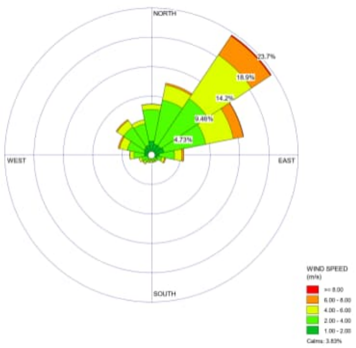
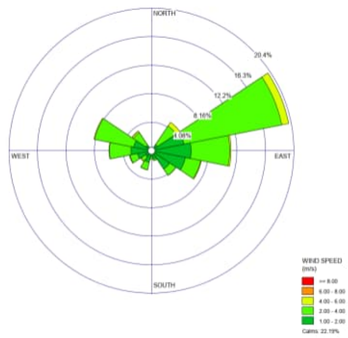
Modelled WRF Meteorological Data	Rosslyn NAQI Meteorological Data
 *Summer*	 *Summer*
 *Autumn*	 *Autumn*
 *Winter*	 *Winter*
 *Spring*	 *Spring*

Figure 6-3: Seasonal wind rose plots for the period January 2020 to December 2022

6.1.4 AMBIENT AIR QUALITY REVIEW

EXISTING SOURCES OF EMISSIONS

A qualitative discussion of identified emission sources in the vicinity of the study site is provided below. Key emission sources in the region are industrial activities and vehicle tailpipe emissions These emission sources contribute towards the air quality status quo within the region, with particulates being of particular concern in this regard.

INDUSTRIAL EMISSIONS

The Project area is home to many heavy industries including, but not limited to, an automotive manufacturer, steel and rubber manufacturing and production of recycled packing materials. Industrial activities release gaseous and particulate emissions into the atmosphere. The main pollutants released from combustion processes include SO_2, CO, carbon dioxide (CO_2), VOCs, NO_x and particulates.

VEHICLE TAILPIPE EMISSIONS

Vehicle tailpipe emissions within the area are considered moderate (DEA, 2019) with vehicles operating on the R566 main road and local roads that accommodate traffic between the surrounding areas. Atmospheric pollutants emitted from vehicles include hydrocarbons, CO, CO_2, NO_x, SO_2 and particulates. These pollutants are emitted from the tailpipe, from the engine and fuel supply system, and from brake linings, clutch plates and tyres. Hydrocarbon emissions, such as C_6H_6, result from the incomplete combustion of fuel molecules in the engine. CO is a product of incomplete combustion and occurs when carbon in the fuel is only partially oxidized to CO_2. NO_x is formed by the reaction of nitrogen and oxygen under high pressure and temperature conditions in the engine. SO_2 is emitted due to the high sulphur content of the fuel. Particulates such as lead originate from the combustion process as well as from brake and clutch linings wear (Samaras and Sorensen, 1999).

LOCAL AIR QUALITY

As part of the National Framework in managing air quality, Government has initiated the National Air Quality Indicator (NAQI) for South Africa. The NAQI has been developed to weigh, balance and present data in such a way as to provide a verifiable and reportable measure of air quality at the national scale. The City of Tshwane currently operates three monitoring stations namely, Rosslyn, Olievenhoutbosch and Soshanguve. This section presents data from the Rosslyn monitoring station which is located 0.79 km northeast of the Rosslyn Facility.

Ambient air quality monitoring undertaken at Rosslyn includes the measurement of SO_2, PM_{10}, $PM_{2.5}$ and NO_x. Monitoring dates to 2008, but data from more recent years (January 2018 to December 2022), as required in the *Modelling Regulations*, have been presented in this assessment. Data recovery for NO_x was less than 60% and has thus been excluded from this assessment. Station coordinates and data recovery for each of the assessed pollutants is provided in **Table 6-6** below.

Table 6-6: Coordinates and data recovery of the Rosslyn monitoring station

Monitoring location	Latitude (°S)	Longitude (°E)	Distance from Facility (km)	Pollutant	Data Recovery (%)				
					2018	2019	2020	2021	2022
Rosslyn	25.625126	28.09474	0.79	SO_2	96	96	98	92	87
				PM_{10}	0 (1)	45 (1)	99	70	78
				$PM_{2.5}$	0 (1)	45 (1)	99	87	81
Note:	(1) Data excluded due to poor data recovery.								

SULPHUR DIOXIDE

Ambient monitoring data for SO_2 was obtained for the January 2018 to December 2022 from the Rosslyn NAQI monitoring station. **Figure 6-4** illustrates the 24-hour average SO_2 concentrations for the January 2018 to December 2022 monitoring period for the area under review. No exceedances of the 24-hour average SO_2 standard (125 µg/m^3) were recorded during the 2018 to 2022 monitoring period. Sources of SO_2 emissions surrounding this station include heavy industries and vehicle tailpipe emissions.

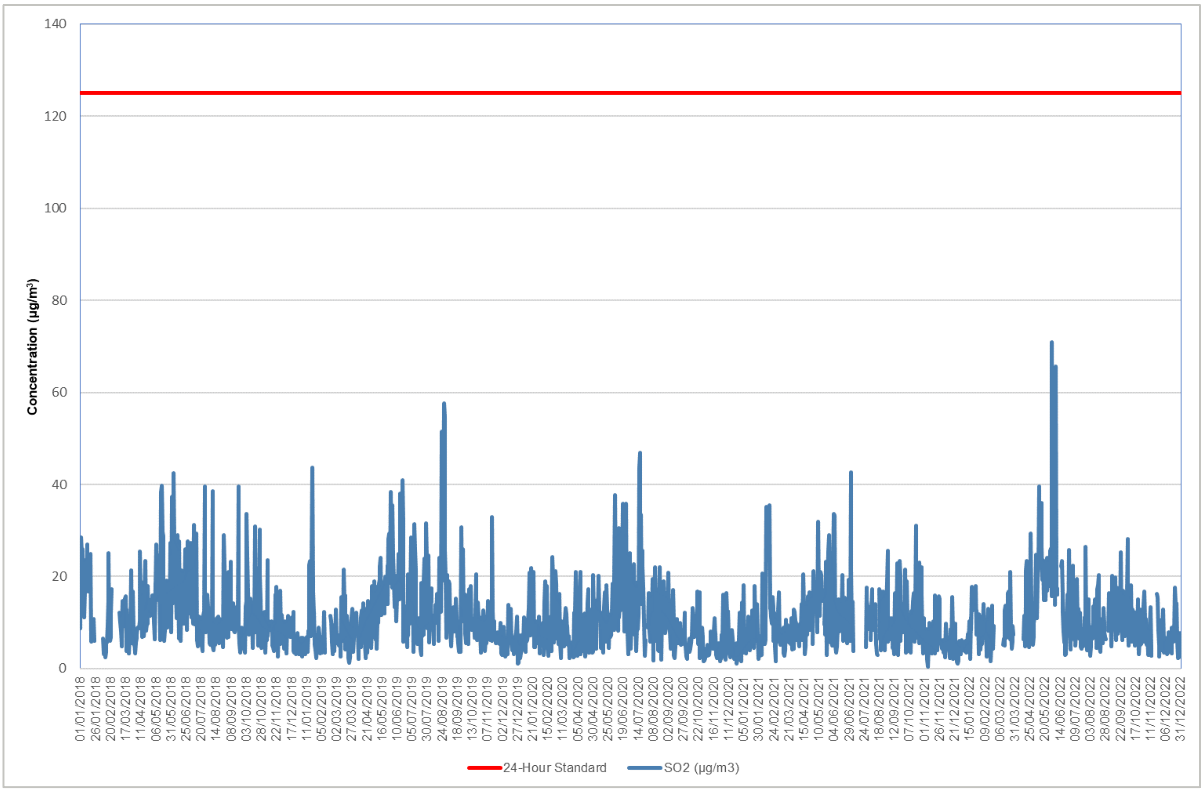


Figure 6-4: 24-Hour average SO_2 concentrations monitored at the Rosslyn NAQI station for the January 2018 to December 2022 period

PARTICULATE MATTER (PM_{10})

Ambient monitoring data for PM_{10} was obtained for the January 2020 to December 2022 from the Rosslyn NAQI monitoring station. **Figure 6-5** illustrates the 24-hour average PM_{10} concentrations for the January 2020 to December 2022 monitoring period for the area under review. The 2020 monitoring period recorded 26 exceedances of the 24-hour PM_{10} standard of 75 µg/m^3, while the 2022 monitoring period recorded ten exceedances. No exceedances were recorded during the 2021 monitoring period. Concentrations recorded at the

Rosslyn NAQI monitoring station during 2020 and 2022 are therefore non-compliant with the NAAQS as only four exceedances of the standard are permitted per calendar year. Annual average PM_{10} concentrations (2020 – 39.7 µg/m^3; 2021 – 25.1 µg/m^3; 2022 – 34.9 µg/m^3) are, however, compliant with the annual average standard of 40 µg/m^3. Potential sources of PM_{10} emissions surrounding this station includes heavy industries and vehicle tailpipe emissions.

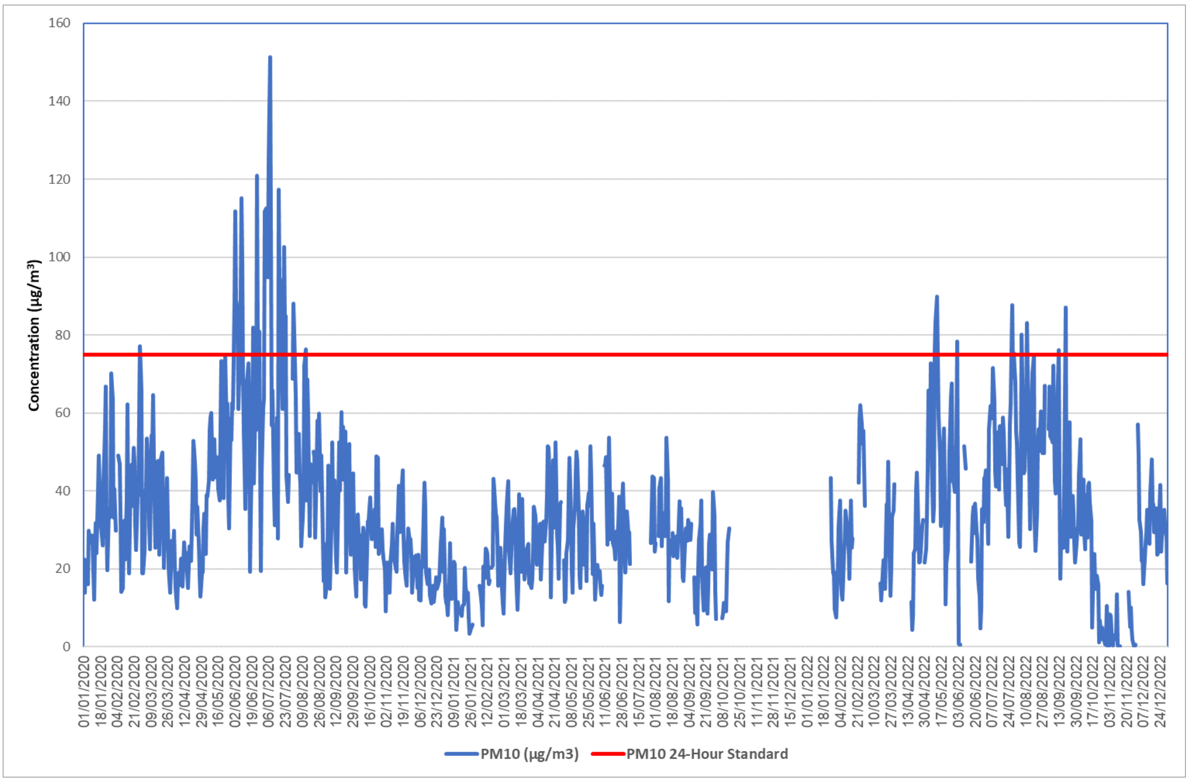


Figure 6-5: 24-Hour average PM_{10} concentrations monitored at the Rosslyn NAQI station for the January 2020 to December 2022 period

PARTICULATE MATTER ($PM_{2.5}$)

Ambient monitoring data for $PM_{2.5}$ was obtained for the January 2020 to December 2022 from the Rosslyn NAQI monitoring station. **Figure 6-6** illustrates the 24-hour average $PM_{2.5}$ concentrations for the January 2020 to December 2022 monitoring period for the area under review. The 2020 monitoring period recorded 40 exceedances of the 24-hour $PM_{2.5}$ standard of 40µg/m^3, while the 2021 and 2022 monitoring period recorded 33 exceedances and 74 exceedances, respectively. Concentrations recorded at the Rosslyn NAQI monitoring station are therefore non-compliant with the NAAQS as only four exceedances of the standard are permitted per calendar year. Annual average $PM_{2.5}$ concentrations (2020 – 24.2 µg/m^3; 2021 – 21.1 µg/m^3; 2022 – 25.6 µg/m^3) are also non-compliant with the annual average standard of 20 µg/m^3. Potential sources of $PM_{2.5}$ emissions surrounding this station includes heavy industries and vehicle tailpipe emissions.

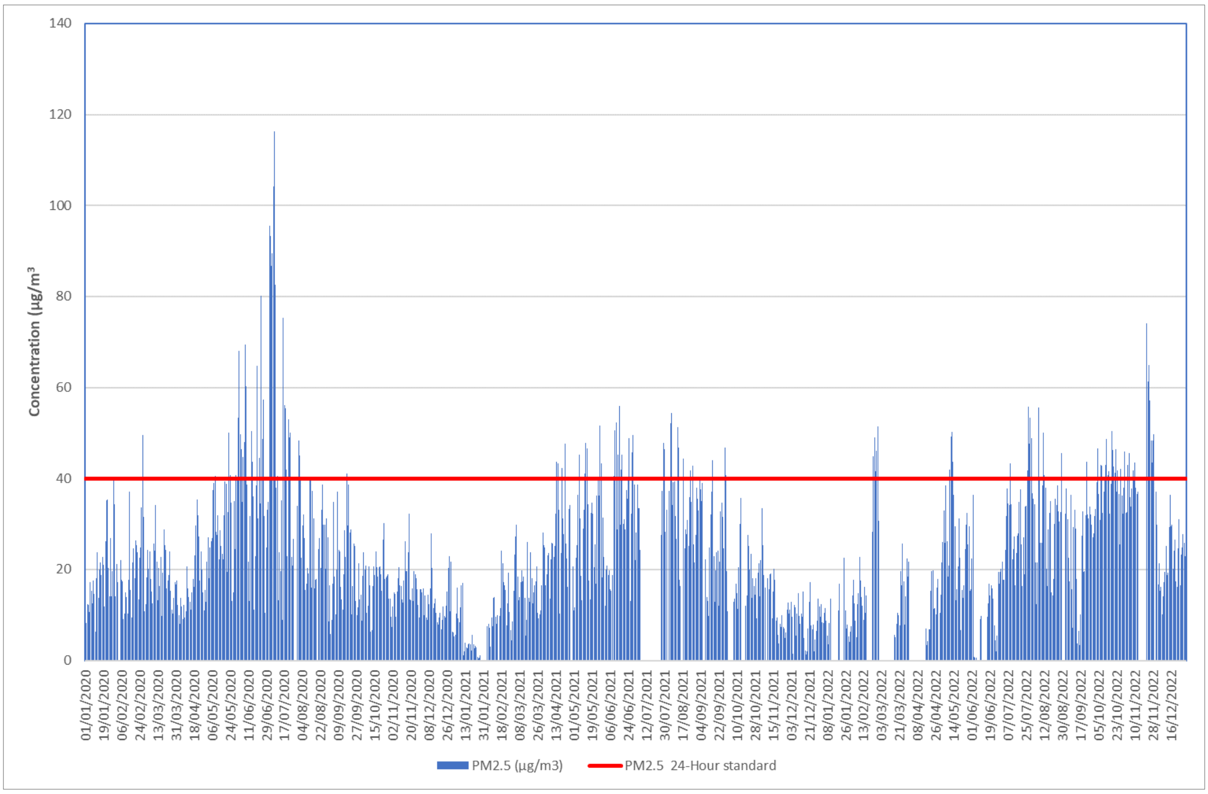


Figure 6-6: 24-Hour average $PM_{2.5}$ concentrations monitored at the Rosslyn NAQI station for the January 2020 to December 2022 period

6.1.5 DISPERSION MODEL METHODOLOGY

Atmospheric dispersion modelling mathematically simulates the transport and fate of pollutants emitted from a source into the atmosphere. Sophisticated software with algorithms that incorporate source quantification, surface contours and topography, as well as meteorology can reliably predict the downwind concentrations of these pollutants.

As per the *Modelling Regulations*, the level of assessment is dependent on technical factors such as geophysical and meteorological context and the complexity of the emissions inventory. The temporal and spatial resolution and accuracy required from a model must also be considered. As such, this assessment is a Level 2 assessment.

Level 2 assessments should be used for air quality impact assessment in standard/generic licence or amendment processes where:

— The distribution of pollutant concentrations and depositions are required in time and space.

— Pollutant dispersion can be reasonable treated by a straight-line, steady-state, Gaussian plume model with first order chemical transformation. Although more complicated processes may be occurring, a more complicated model that explicitly treats these processes may not be necessary depending on the purposes of the modelling and the zone of interest.

— Emissions are from sources where the greatest impacts are in the order of a few kilometres (less than 50 km), downwind.

For this assessment, the AERMOD dispersion modelling software was utilised. AERMOD is a new generation air dispersion model designed for short-range dispersion of airborne pollutants in steady state plumes that uses hourly sequential meteorological files with pre-processors to generate flow and stability regimes for each hour, that produces output maps of plume spread with key isopleths for visual interpretation and enables, through its statistical output, direct comparisons with the latest National and International ambient air quality standards for compliance testing. AERMOD is the recommended level 2 model prescribed in the Modelling Regulations.

The AERMOD atmospheric dispersion modelling system is an integrated system that includes three modules:

— A steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions from stationary industrial sources.
— A meteorological data pre-processor (AERMET) that accepts surface meteorological data, upper air soundings, and optionally, data from on-site instrument towers. It then calculates atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Obukhov length (often referred to as Monin-Obukhov length) and surface heat flux.
— A terrain pre-processor (AERMAP) with the main purpose of providing a physical relationship between terrain features and the behaviour of air pollution plumes. It generates location and height data for each receptor location. It also provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills.

MODELLING SCENARIOS

For this study, one dispersion modelling simulation was undertaken (Proposaed Operating Conditions).

METEOROLOGICAL INPUT

The meteorological data that was used in the dispersion model was obtained from Lakes Environmental Consultants Inc., in the form of WRF Pre-processed meteorological data, for the period January 2020 – December 2022. This is the most complete and representative dataset for the site.

TERRAIN INPUT

Terrain influences dispersion of pollutants, especially during periods of stable conditions. The National Aeronautics and Space Administration (NASA) Shuttle Radar Topographic Mission (SRTM) digital elevation model 1-arc data (resolution 30 m x 30 m) was extracted for input into the model to account for terrain influences on dispersion. For the land use categorization, the Global Land Cover Characterization Global Coverage – Version 3 (1 km x 1 km resolution) was used.

GRID RESOLUTION

According to the *Modelling Regulations*, the selected size and extent of the model domain is influenced by factors such as source buoyancy, terrain features (i.e. mountains) and the location of contributing sources. Larger domains are recommended for elevated, buoyant sources (e.g. stacks) while smaller domains are considered sufficient for lower release heights, particularly if emissions are at or near ambient temperature. The modelling domain for this study was defined as 30 km x 30 km, centred over the Strandfoam Rosslyn operations. The *Modelling Regulations* specify the use of a multi-tier grid and recommend specific tier resolutions. In line with these requirements, the receptor grid resolution was 50 m x 50 m along the property boundary; 100 m x 100 m up to 5,000 m from the centre of the site; 250 m x 250 m up to 10,000 m from the centre of the site; and 1,000 m x 1,000 m thereafter.

MODEL INPUT PARAMETERS

Table 6-7 lists the key parameters used in the level 2 dispersion model for the Rosslyn Facility.

Table 6-7: Key model inputs used in the assessment

Parameter		Model Input
Model		
Assessment Level		Level 2
Dispersion Model		AERMOD View 12.0.0
Supporting Models		AERMET and AERMAP
Emissions		
Pollutants modelled		TVOCs, benzene, toluene, xylene, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, MEC, TDI and propylene oxide
Scenarios		Operational
Chemical transformation		Total conversion method
Exponential decay		A half-life of 4 hours
Settings		
Terrain setting		Elevated
Terrain data		SRTM1
Terrain data resolution (m)		Global ~ 30
Land characteristics		Urban
Bowen ratio		0.93
Surface albedo		0.29
Surface roughness		0.04
Grid Receptors		
Modelling domain (km)		30 x 30
Grid resolution	Tier I	100 m
	Tier II	250 m
	Tier III	1,000 m

MODEL OUTPUTS

The model outputs that follow (**Section 6.1.6**) show simulated pollutant concentrations experienced at ground level for the Rosslyn operations. Where applicable, ambient concentrations are compared with the NAAQS or relevant international guidelines (in the absence of local standards) to assess impact. For the purposes of this investigation, the following statistical outputs were generated:

— The long-term scenario refers to the period average concentration, which is calculated by averaging all hourly concentrations for the three-year assessment period. The calculation is conducted for each grid point within the modelling domain.

— 99^{th} percentile (P99) concentrations are calculated for comparison with short-term NAAQS as specified in the *Modelling Regulations*.

— 100^{th} percentile (P100) concentrations are calculated for comparison with international health guidelines if a lower percentile threshold is not specified by the guidance documentation. This is considered environmentally conservative.

As defined in the *Modelling Regulations*, ambient air quality standards and guidelines are applied to areas outside the facility fenceline (i.e. beyond the facility boundary). Within the facility boundary, environmental conditions are prescribed by occupational health and safety criteria. As such, tabular model outputs in this assessment are presented for each sensitive receptor, the maximum concentration on the facility boundary and the maximum concentration off-site (i.e. beyond the facility boundary).

6.1.6 DISPERSION MODEL RESULTS

Simulated pollutant concentrations for 1-hour, 8-hour, 24-hour (where applicable) and assessment period (i.e. representing the annual average) averaging periods at each discrete receptor are presented in **Table 6-9**. Isopleth maps showing pollutant dispersion across the study area are presented in **Figure 6-7** to **Figure 6-31**. Where applicable, simulated concentrations have been evaluated against their respective NAAQS or international guidelines. Key findings are as follows:

- SO_2 emissions do not result in exceedances of the ambient SO_2 1-hour (350 µg/m^3), 24-hour (125 µg/m^3) or annual (50 µg/m^3) NAAQS.
- NO_2 emissions do not result in exceedances of the ambient NO_2 1-hour (200 µg/m^3) or annual (40 µg/m^3) NAAQS.
- CO emissions do not result in exceedances of the ambient CO 1-hour (30,000 µg/m^3) or 8-hour (10,000 µg/m^3) NAAQS.
- PM_{10} emissions do not result in exceedances of the ambient PM_{10} 24-hour (75 µg/m^3) or annual (40 µg/m^3) NAAQS.
- $PM_{2.5}$ emissions do not result in exceedances of the ambient $PM_{2.5}$ 24-hour (40 µg/m^3) or annual (20 µg/m^3) NAAQS.
- Benzene emissions do not result in exceedances of the ambient benzene 1-hour (27 µg/m^3) or 8-hour (3 µg/m^3) OEHHA guideline nor the annual (5 µg/m^3) NAAQS.
- Toluene emissions do not result in exceedances of the ambient toluene 1-hour (4,500 µg/m^3) TCEQ guideline nor the 8-hour (830 µg/m^3) or annual (420 µg/m^3) OEHHA guidelines.
- Xylene emissions do not result in exceedances of the ambient xylene 1-hour (2,200 µg/m^3) or annual (180 µg/m^3) TCEQ guidelines:
- MEC emissions do not result in exceedances of the ambient MEC 1-hour (3,600 µg/m^3) or annual (350 µg/m^3) TCEQ guidelines.
- TDI emissions do not result in exceedances of the ambient TDI 1-hour (0.7 µg/m^3) TCEQ guideline nor the annual (0.008 µg/m^3) OEHHA guideline. TDI emissions do not result in exceedances of the 8-hour (0.015 µg/m^3) OEHHA guideline outside of Strandfoam's property boundary. Exceedance of the TDI 8-hour OEHHA guideline only occurs on Strandfoam's property boundary.
- Propylene oxide emissions do not result in exceedances of the ambient propylene oxide 1-hour (1,000 µg/m^3) TCEQ guideline nor the annual (30 µg/m^3) OEHHA guideline.
- TVOC emissions do not exceed the annual benzene (5 µg/m^3) NAAQS at any of the sensitive receptors. Exceedance of the NAAQS only extends ~78 m across the eastern fenceline.
  - It must be noted, however, that comparison of TVOC against the benzene NAAQS is considered conservative, as TVOCs comprise a vast array of compounds and the NAAQS is only applicable to the benzene proportion. As such, the benzene NAAQS cannot be used in this instance to demonstrate compliance, however, has been used here as a conservative impact reference threshold.
- Peak concentrations across all pollutants occur either within the operational boundary or along the facility's fenceline. It is highlighted that the eastern fenceline on which these peak concentrations occur is immediately adjacent to the indoor raw material storage and polyurethane foam production building.

CUMULATIVE ASSESSMENT

The National Framework for Air Quality Management in South Africa calls for air quality assessment in terms of cumulative impacts rather than the contributions from an individual facility. Compliance with the National Ambient Air Quality Standard (NAAQS) is to be determined by considering all local and regional contributions to background concentrations. For each averaging time, the sum of the model predicted concentration (C_P) and the background concentration (C_B) must be compared with the NAAQS. The background concentrations C_B must be the sum of contributions from non-modelled local sources and regional background air quality. If the sum of background and predicted concentrations ($C_B + C_P$) is more than the NAAQS, the design of the facility must be reviewed (including pollution control equipment) to ensure compliance with NAAQS. Compliance assessments must provide room for future permits to new emissions sources, while maintaining overall compliance with NAAQS. For the different facility locations and averaging times, the comparisons with NAAQS must be based on recommendations in **Table 6-8.**

Table 6-8: Summary of recommended procedures for assessing compliance with NAAQS

Facility Location	Annual NAAQS	Short-term NAAQS (24 hours or less)
Isolated facility not influenced by other sources; C_B insignificant*.	Highest C_P must be less than the NAAQS, no exceedances allowed.	99th percentile concentrations must be less than the NAAQS. Wherever one year is modelled, the highest concentrations shall be considered.
Facilities influenced by background sources e.g. in urban areas and priority areas.	Sum of the highest C_P and background concentrations must be less that the NAAQS, no exceedances allowed.	Sum of the 99th percentile concentrations and background CB must be less than the NAAQS. Wherever one year is modelled, the highest concentrations shall be considered.

Since the Rosslyn facility is operational, existing background concentrations were not used to assess the cumulative impact of the Rosslyn facility as inclusion of any baseline data would essentially double account for emissions from the facility (in the background measurements and the inputted emission rates).

Table 6-9: Simulated pollutant concentrations at sensitive receptors

Pollutant	Averaging period	Standard / Guideline (µg/m³)	Reference	Predicted concentrations (µg/m³)															
				Off-site peak	Boundary peak	Sensitive receptor													
						SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10	SR11	SR12	SR13	SR14
SO_2	1-hour	350	NAAQS	5.58E+00	1.49E+01	8.86E-02	1.41E-02	9.41E-03	1.55E-01	1.69E-01	2.58E-02	8.39E-03	6.71E-03	6.24E-03	3.12E-03	3.84E-03	4.70E-03	3.48E-03	4.97E-03
	24-hour	125	NAAQS	1.67E+00	4.16E+00	2.87E-02	5.43E-03	3.53E-03	5.51E-02	5.29E-02	1.84E-02	6.15E-03	4.39E-03	2.93E-03	1.75E-03	1.80E-03	3.00E-03	1.78E-03	2.48E-03
	Period	50	NAAQS	3.46E-01	9.66E-01	6.80E-04	1.49E-02	1.24E-02	1.62E-03	5.40E-04	4.10E-04	4.30E-04	2.10E-04	2.50E-04	3.00E-04	2.30E-04	3.40E-04	6.93E-03	9.90E-04
NO_2	1-hour	200	NAAQS	4.00E+00	1.06E+01	6.41E-02	1.05E-02	7.20E-03	1.11E-01	1.22E-01	2.00E-02	6.82E-03	5.69E-03	5.01E-03	2.88E-03	3.33E-03	4.04E-03	3.04E-03	4.25E-03
	Period	40	NAAQS	2.48E-01	6.91E-01	5.04E-03	7.50E-04	5.20E-04	1.08E-02	8.96E-03	1.23E-03	4.40E-04	3.40E-04	3.40E-04	1.90E-04	2.10E-04	2.50E-04	2.00E-04	2.80E-04
CO	1-hour	30,000	NAAQS	1.60E+00	4.26E+00	2.57E-02	4.19E-03	2.88E-03	4.45E-02	4.86E-02	8.01E-03	2.73E-03	2.28E-03	2.00E-03	1.15E-03	1.33E-03	1.61E-03	1.22E-03	1.70E-03
	8-hour	10,000	NAAQS	8.13E-01	2.85E+00	1.50E-02	3.06E-03	1.94E-03	3.41E-02	2.61E-02	6.55E-03	2.24E-03	1.80E-03	1.67E-03	9.71E-04	1.07E-03	1.41E-03	1.06E-03	1.42E-03
PM_{10}	24-hour	75	NAAQS	2.58E-01	6.40E-01	4.43E-03	9.21E-04	6.59E-04	8.52E-03	8.31E-03	3.02E-03	1.13E-03	7.82E-04	5.42E-04	3.91E-04	3.70E-04	5.30E-04	3.86E-04	5.02E-04
	Period	40	NAAQS	5.33E-02	1.49E-01	1.08E-03	1.60E-04	1.10E-04	2.31E-03	1.93E-03	2.60E-04	9E-005	7E-005	7E-005	4E-005	5E-005	5E-005	4E-005	6E-005
$PM_{2.5}$	24-hour	40	NAAQS	0.19777	0.49031	3.39E-03	7.05E-04	5.05E-04	6.53E-03	6.37E-03	2.31E-03	8.69E-04	5.99E-04	4.15E-04	2.99E-04	2.84E-04	4.06E-04	2.96E-04	3.84E-04
	Period	20	NAAQS	4.09E-02	1.14E-01	8.30E-04	1.20E-04	9E-005	1.77E-03	1.48E-03	2.00E-04	7E-005	6E-005	6E-005	3E-005	3E-005	4E-005	3E-005	5E-005
Benzene	1-hour	27	OEHHA	7.09E-02	1.40E-01	2.98E-04	7.32E-05	7.05E-05	6.25E-04	3.69E-04	1.30E-04	3.33E-05	2.06E-05	3.15E-05	1.41E-05	1.98E-05	2.47E-05	1.78E-05	2.57E-05
	8-hour	3	OEHHA	3.63E-02	7.68E-02	3.87E-04	6.57E-05	1.04E-04	6.88E-04	4.47E-04	1.73E-04	2.35E-05	1.44E-05	2.22E-05	1.01E-05	1.37E-05	1.76E-05	1.25E-05	1.83E-05
	Period	5	NAAQS	5.36E-03	8.02E-02	4.00E-05	1.00E-05	1.00E-05	9.00E-05	7.00E-05	1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	1-hour	4,500	TCEQ	8.38E-02	1.65E-01	4.00E-04	9.20E-05	9.25E-05	8.30E-04	5.29E-04	1.56E-04	4.07E-05	2.55E-05	3.87E-05	1.75E-05	2.42E-05	3.03E-05	2.19E-05	3.16E-05
	8-hour	830	OEHHA	4.28E-02	9.10E-02	4.60E-04	7.75E-05	1.24E-04	8.13E-04	5.29E-04	2.07E-04	2.80E-05	1.73E-05	2.65E-05	1.21E-05	1.63E-05	2.09E-05	1.50E-05	2.18E-05
	Period	420	OEHHA	6.57E-03	1.32E-02	5E-005	1E-005	1E-005	1.10E-04	9E-005	2E-005	1E-005	0.00E+00	1E-005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xylene	1-hour	2,200	TCEQ	7.44E-02	1.45E-01	3.15E-04	7.74E-05	7.46E-05	6.61E-04	3.91E-04	1.37E-04	3.52E-05	2.18E-05	3.34E-05	1.50E-05	2.09E-05	2.62E-05	1.88E-05	2.72E-05
	Period	180	TCEQ	5.78E-03	1.16E-02	5.00E-05	1.00E-05	1.00E-05	1.00E-04	7.00E-05	1.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MEC	1-hour	3,600	TCEQ	9.00E+00	4.99E+01	2.64E-01	6.34E-02	6.40E-02	5.63E-01	3.18E-01	9.95E-02	2.66E-02	1.67E-02	2.64E-02	1.14E-02	1.58E-02	1.97E-02	1.43E-02	2.06E-02
	Period	350	TCEQ	1.84E+00	1.23E+01	3.83E-02	8.26E-03	5.24E-03	8.61E-02	5.57E-02	9.87E-03	3.24E-03	2.05E-03	3.34E-03	1.38E-03	1.89E-03	2.38E-03	1.74E-03	2.49E-03
TDI	1-hour	0.7	TCEQ	4.05E-03	2.25E-02	1.19E-04	2.85E-05	2.88E-05	2.54E-04	1.43E-04	4.48E-05	1.20E-05	7.51E-06	1.19E-05	5.13E-06	7.11E-06	8.88E-06	6.44E-06	9.25E-06
	8-hour	0.015	OEHHA	2.98E-03	1.64E-02	1.28E-04	2.02E-05	3.90E-05	2.36E-04	1.54E-04	6.29E-05	8.54E-06	5.28E-06	8.41E-06	3.66E-06	4.94E-06	6.30E-06	4.56E-06	6.55E-06
	Period	0.008	OEHHA	8.30E-04	5.55E-03	2.00E-05	0.00E+00	0.00E+00	4.00E-05	3.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Propylene Oxide	1-hour	1,000	TCEQ	8.08E+01	1.78E+02	7.93E-01	2.23E-01	1.64E-01	1.85E+00	1.25E+00	3.42E-01	1.24E-01	9.56E-02	1.01E-01	3.83E-02	4.46E-02	7.03E-02	6.81E-02	8.84E-02
	Period	30	OEHHA	6.15E+00	1.95E+01	7.86E-02	1.36E-02	9.45E-03	1.51E-01	1.37E-01	2.21E-02	7.12E-03	5.39E-03	5.87E-03	2.33E-03	2.90E-03	4.00E-03	3.36E-03	4.76E-03
TVOC	1-hour	NA	-	8.72E+01	1.86E+02	1.06E+00	2.54E-01	2.23E-01	2.32E+00	1.49E+00	4.43E-01	1.39E-01	1.06E-01	1.13E-01	4.38E-02	5.29E-02	7.67E-02	7.34E-02	9.82E-02
	Period	NA	-	8.02E+00	3.19E+01	1.18E-01	2.20E-02	1.48E-02	2.38E-01	1.93E-01	3.21E-02	1.04E-02	7.48E-03	9.26E-03	3.73E-03	4.82E-03	6.42E-03	5.13E-03	7.29E-03

Red: exceeds applicable reference threshold

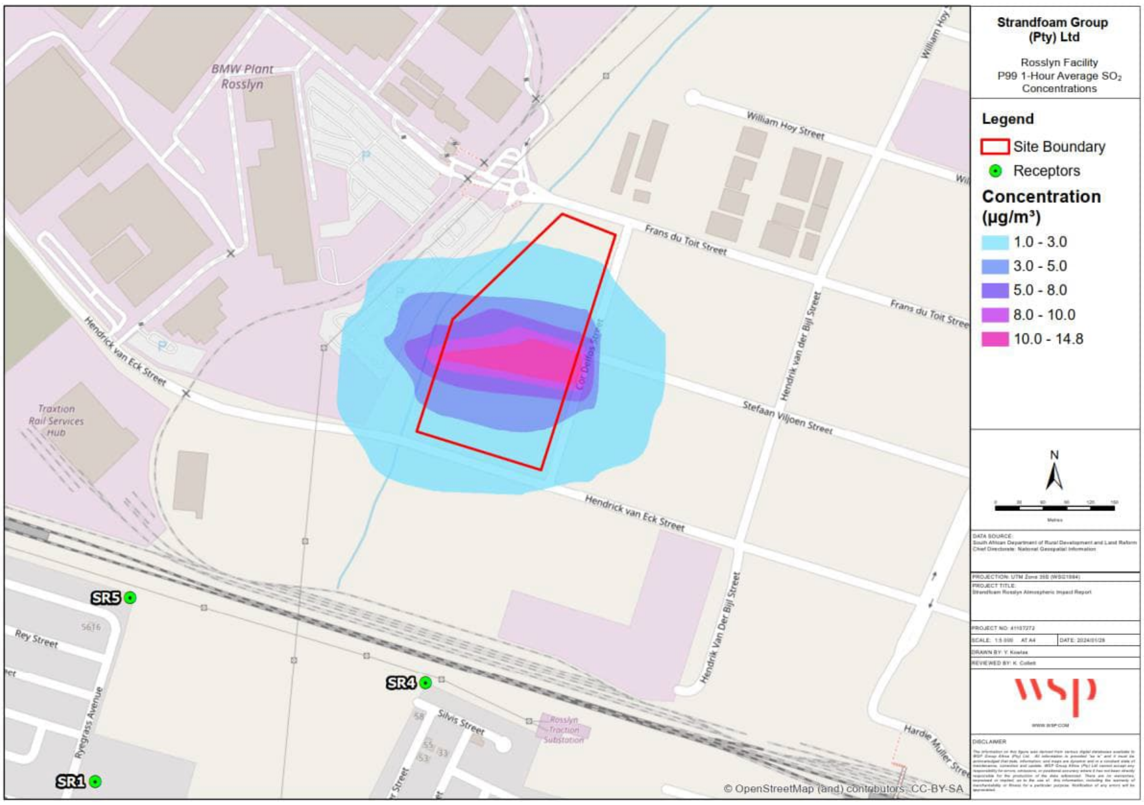


Figure 6-7: P99 1-hour average SO_2

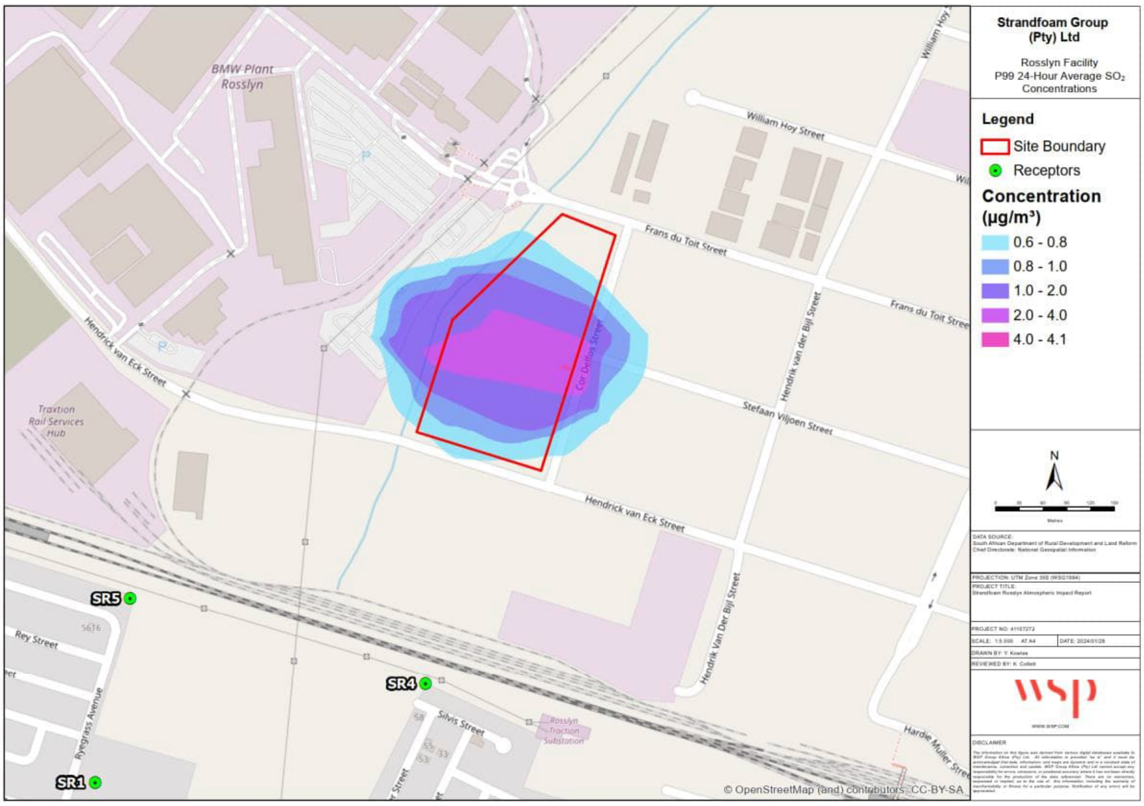


Figure 6-8: P99 24-hour average SO_2

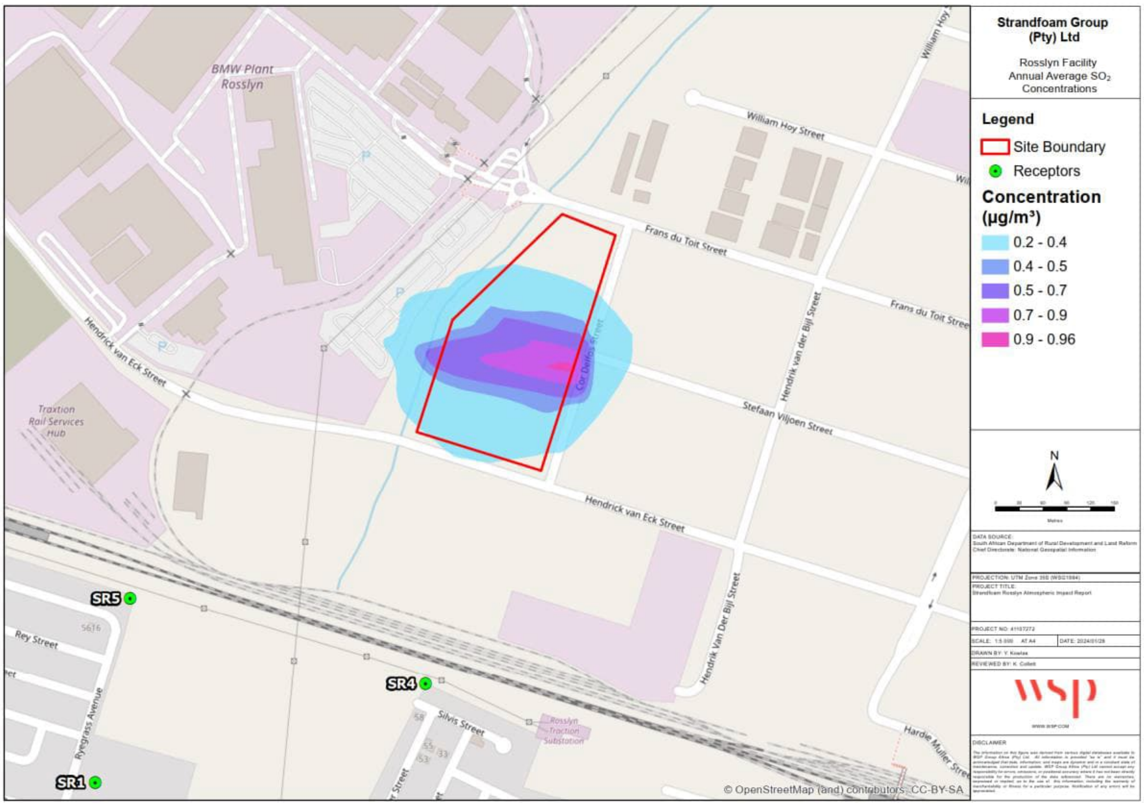


Figure 6-9: Period average SO_2

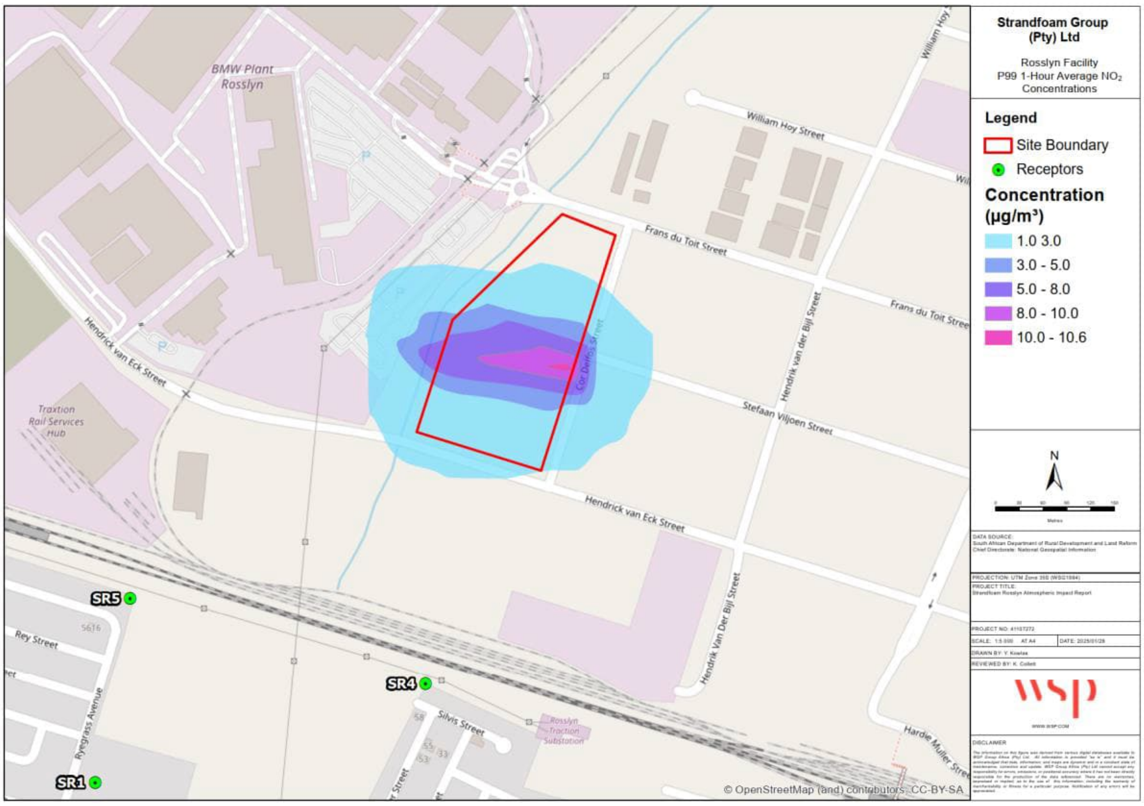


Figure 6-10: P99 1-hour average NO_2

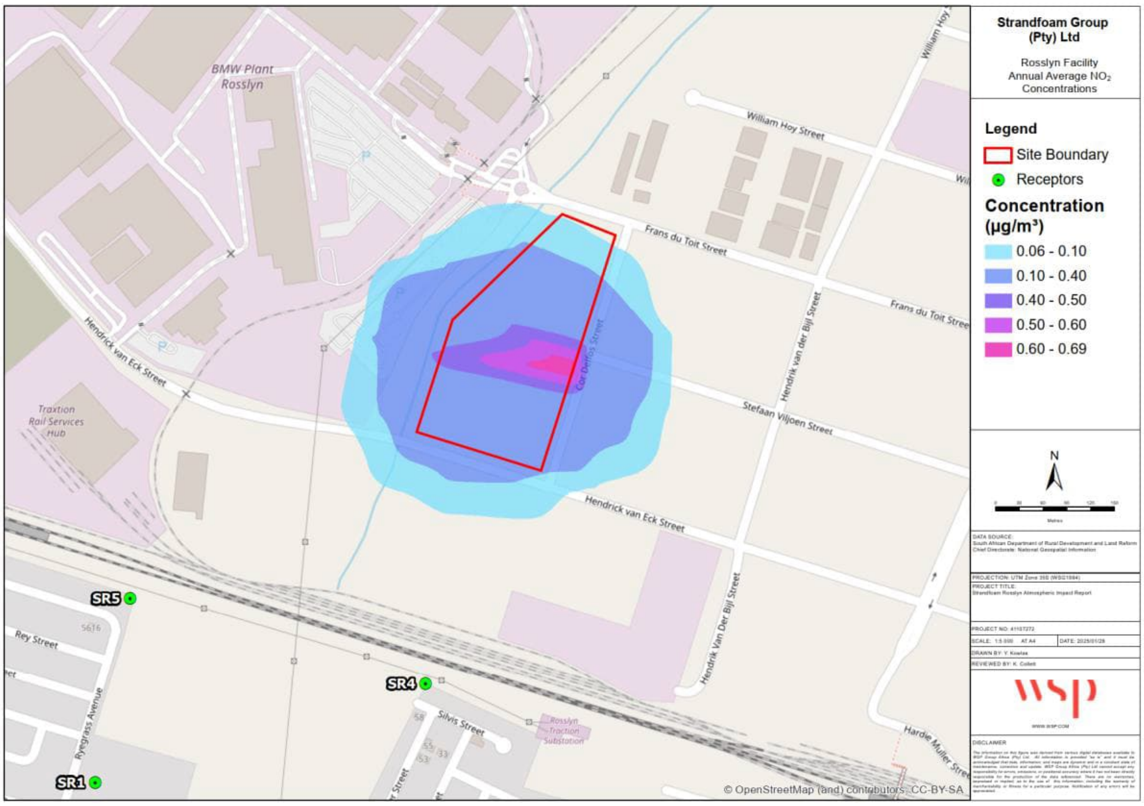


Figure 6-11: Period average NO_2

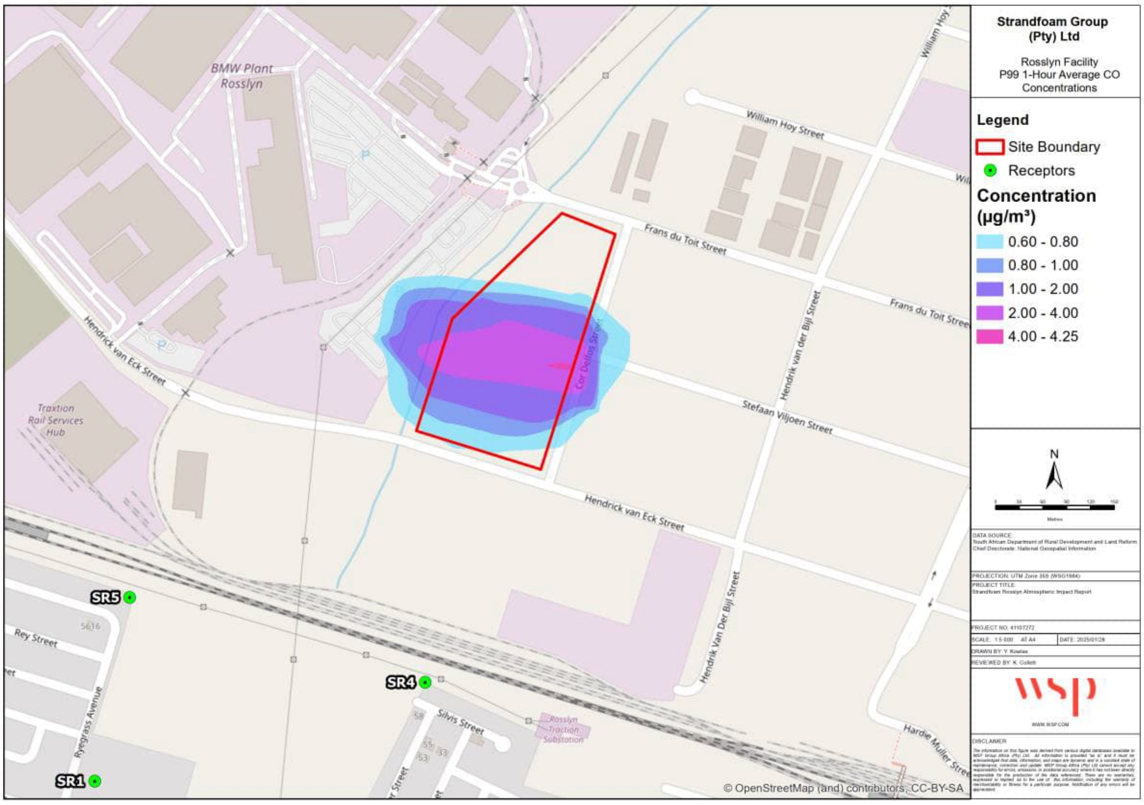


Figure 6-12: P99 1-hour average CO

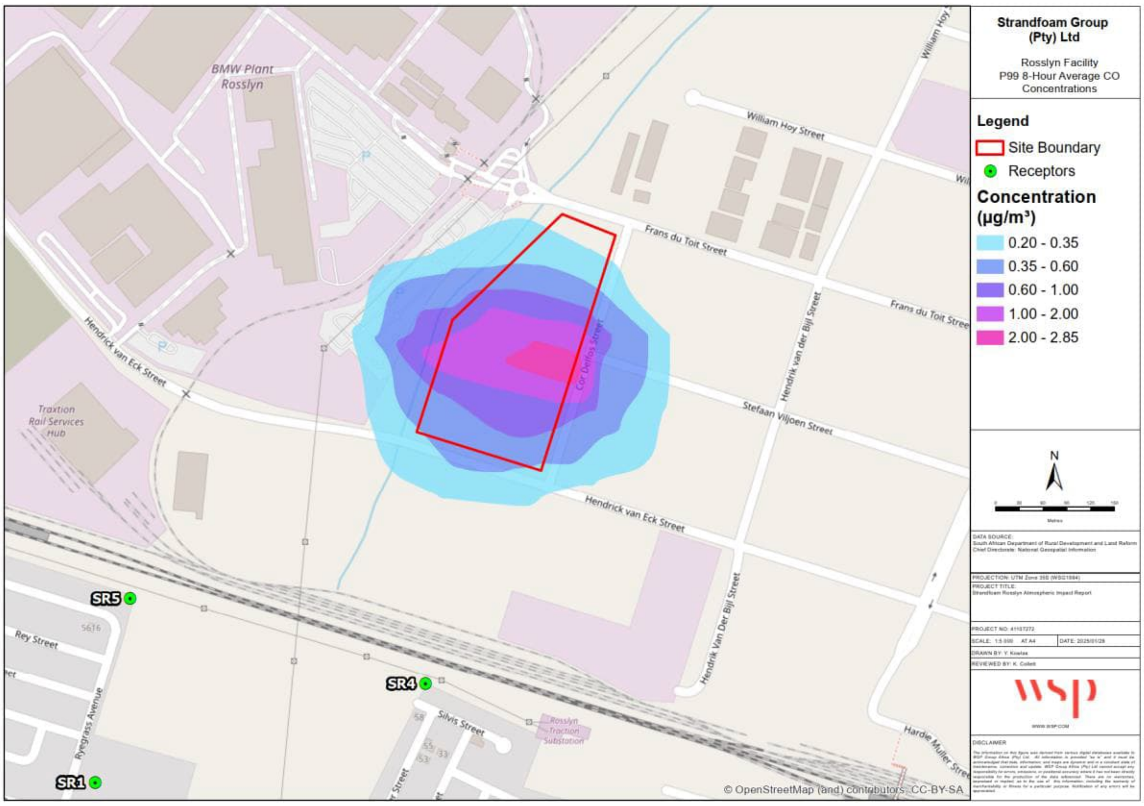


Figure 6-13: P99 8-hour average CO

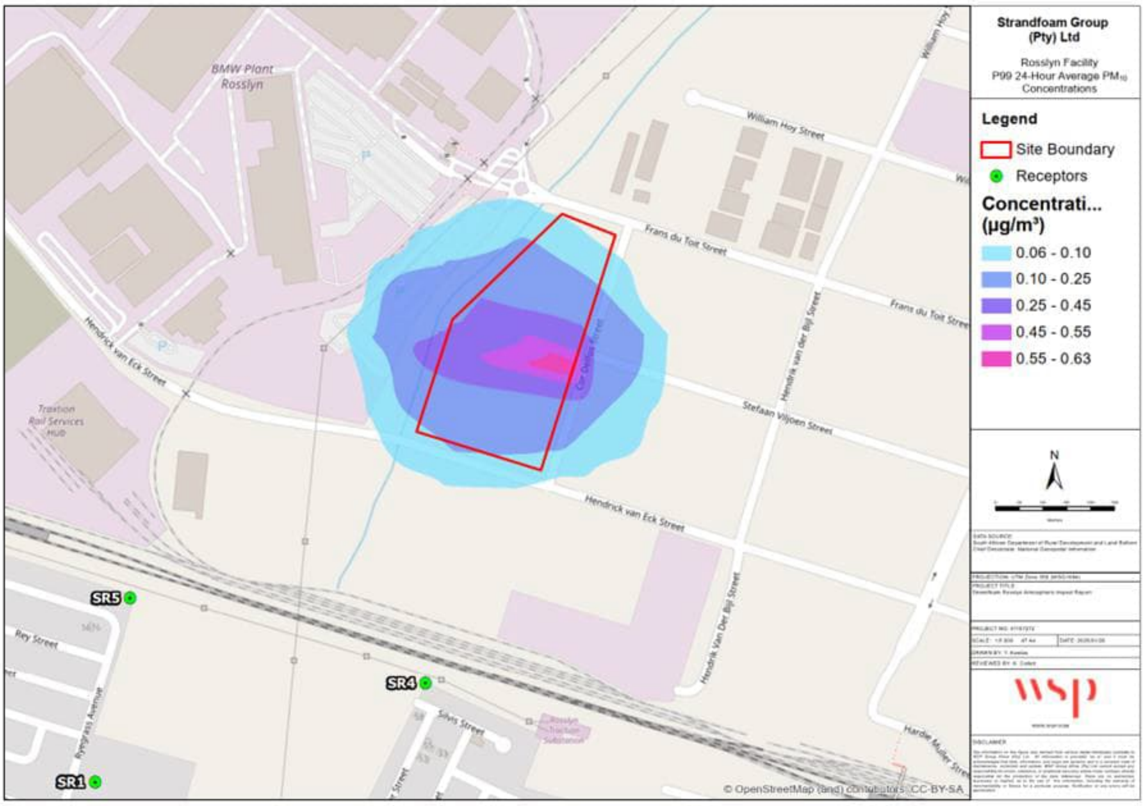


Figure 6-14: P99 24-hour average PM_{10}

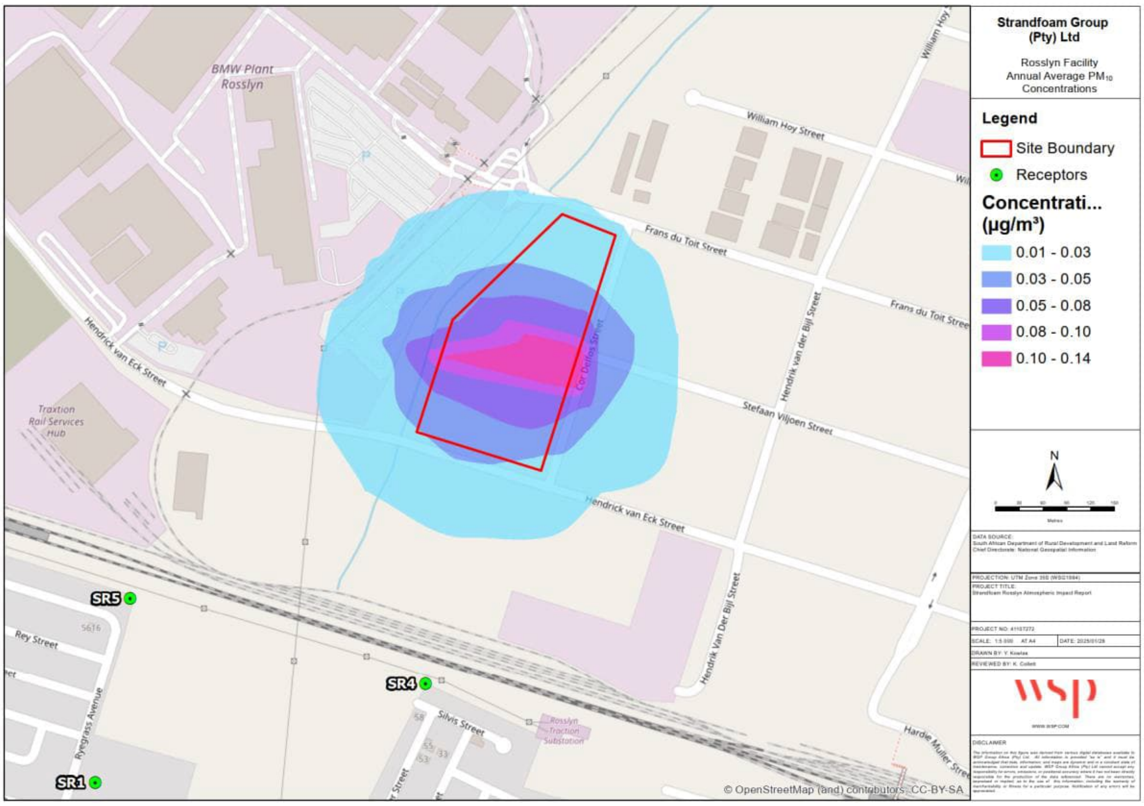


Figure 6-15: Period average PM_{10}

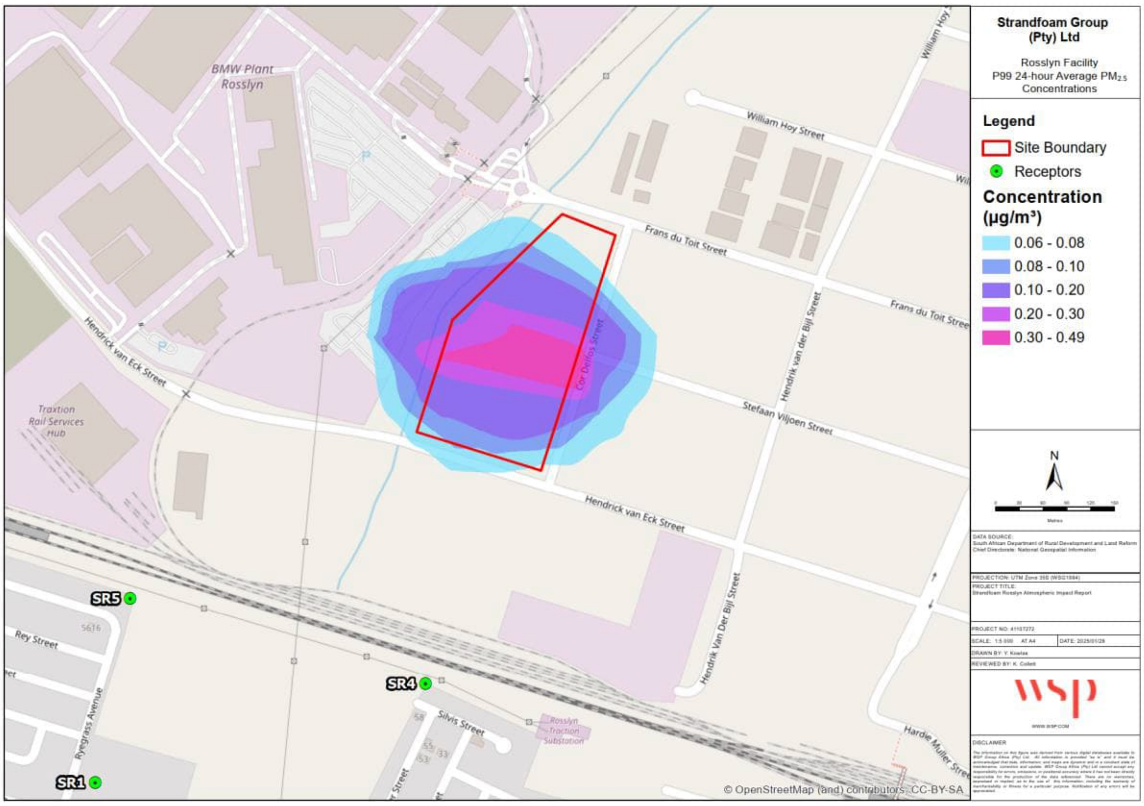


Figure 6-16: P99 24-hour average $PM_{2.5}$

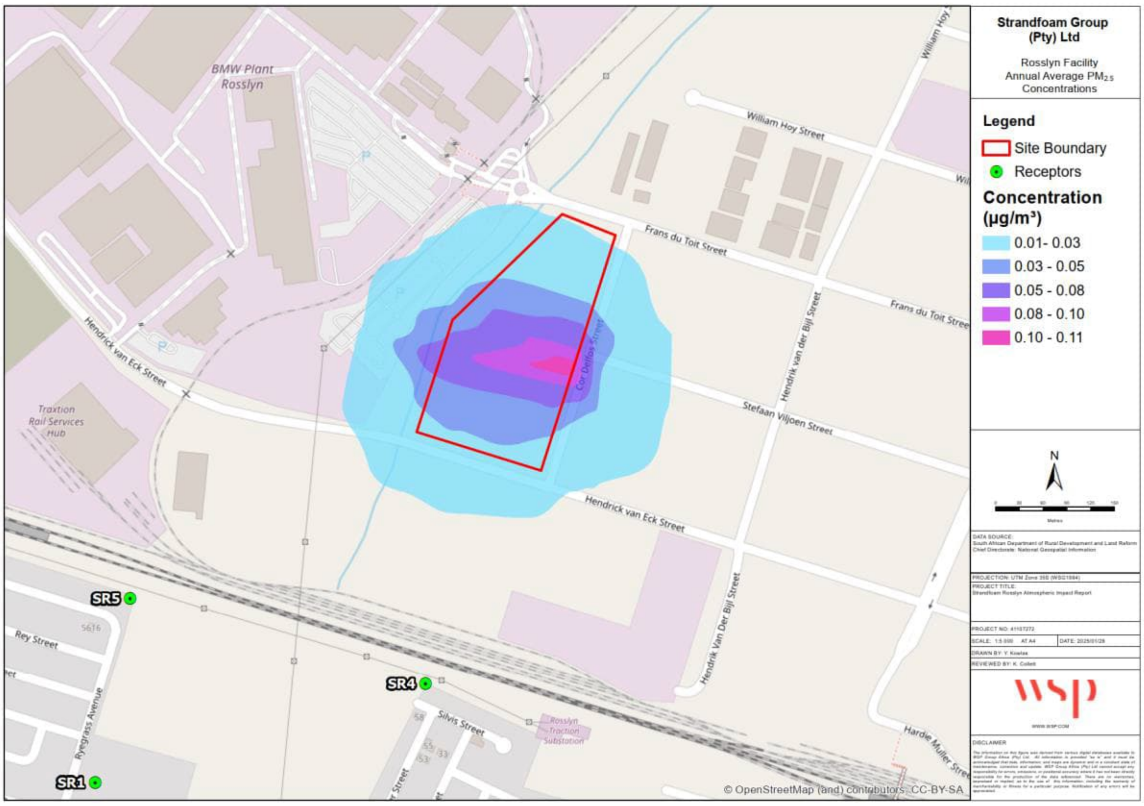


Figure 6-17: **Period average $PM_{2.5}$**

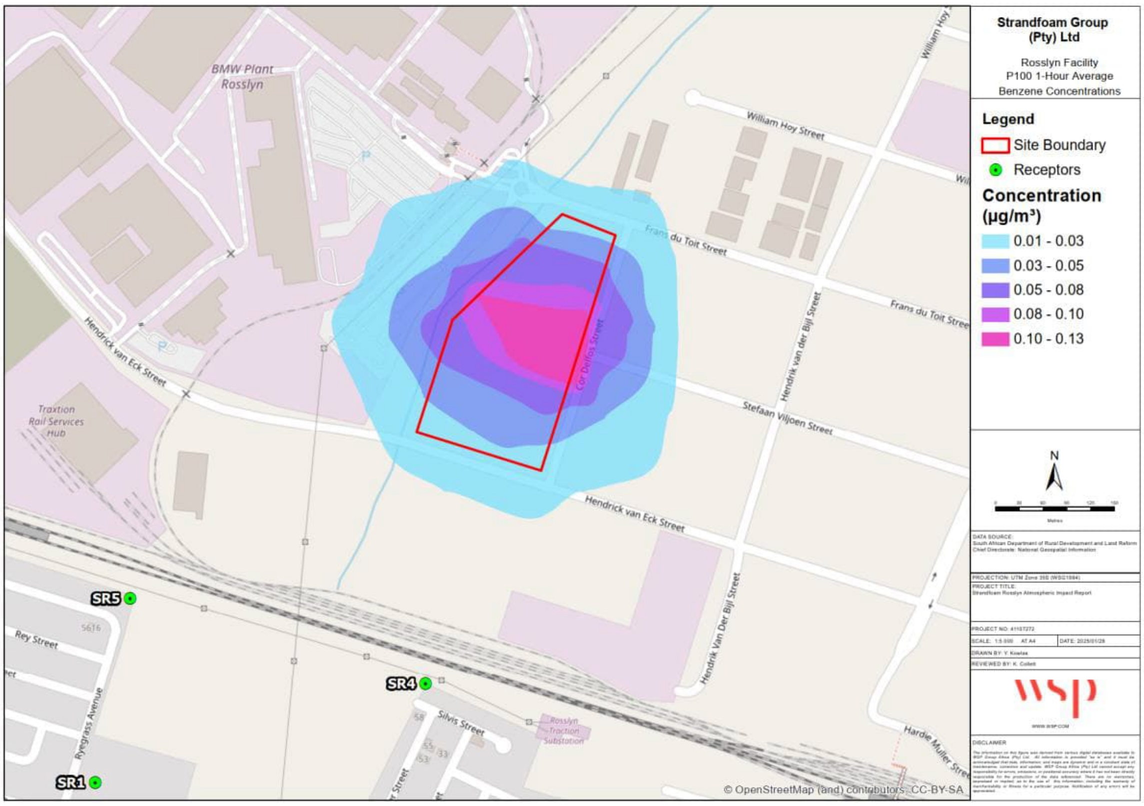


Figure 6-18: **P100 1-hour average benzene**

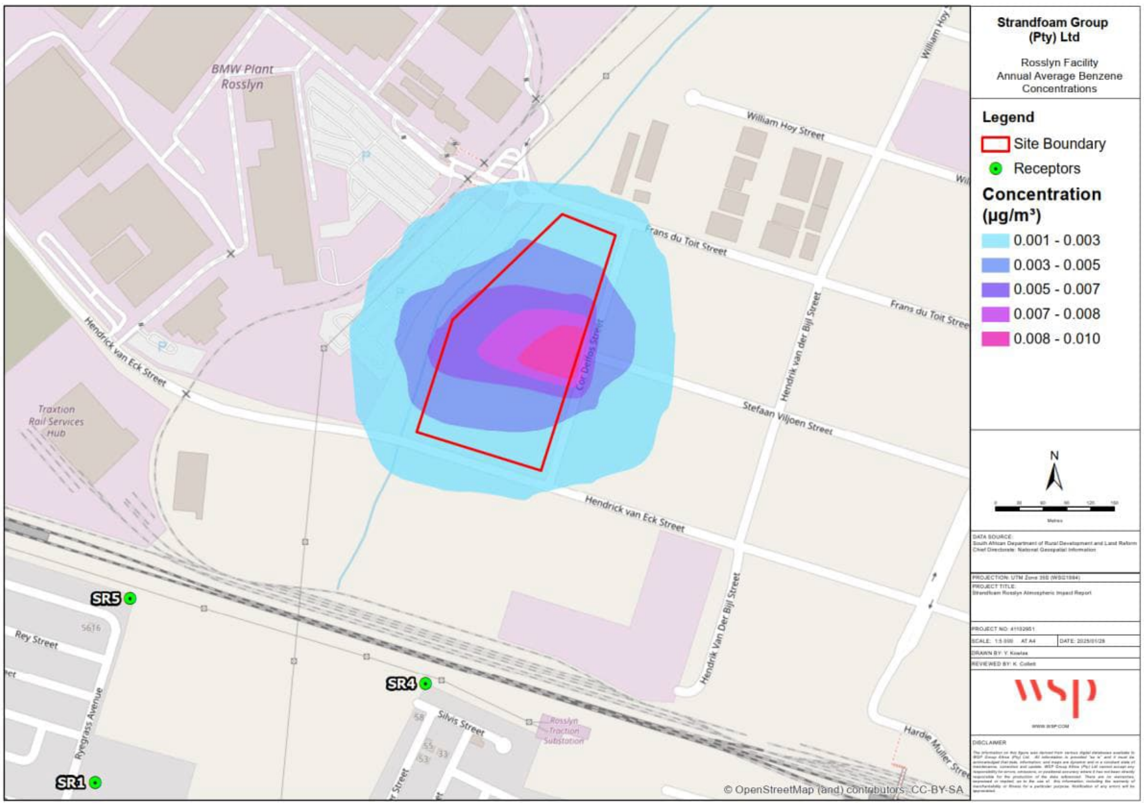


Figure 6-19: Period average benzene

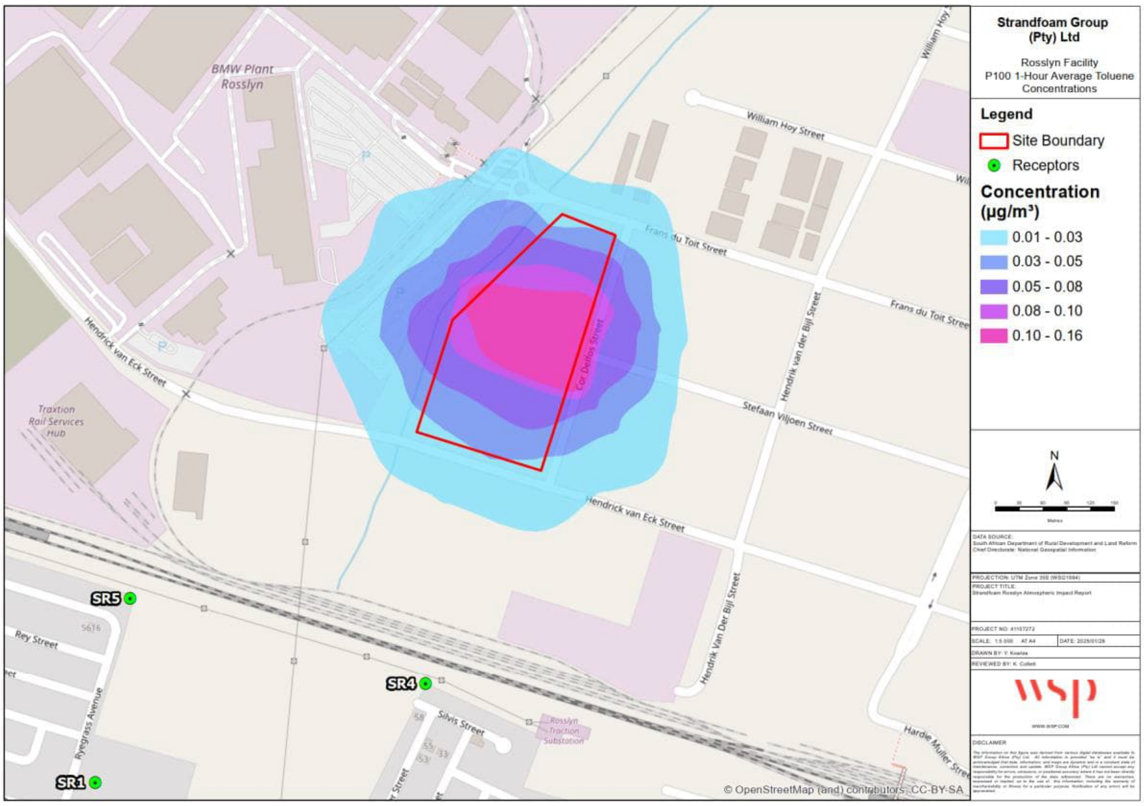


Figure 6-20: P100 1-hour average toluene

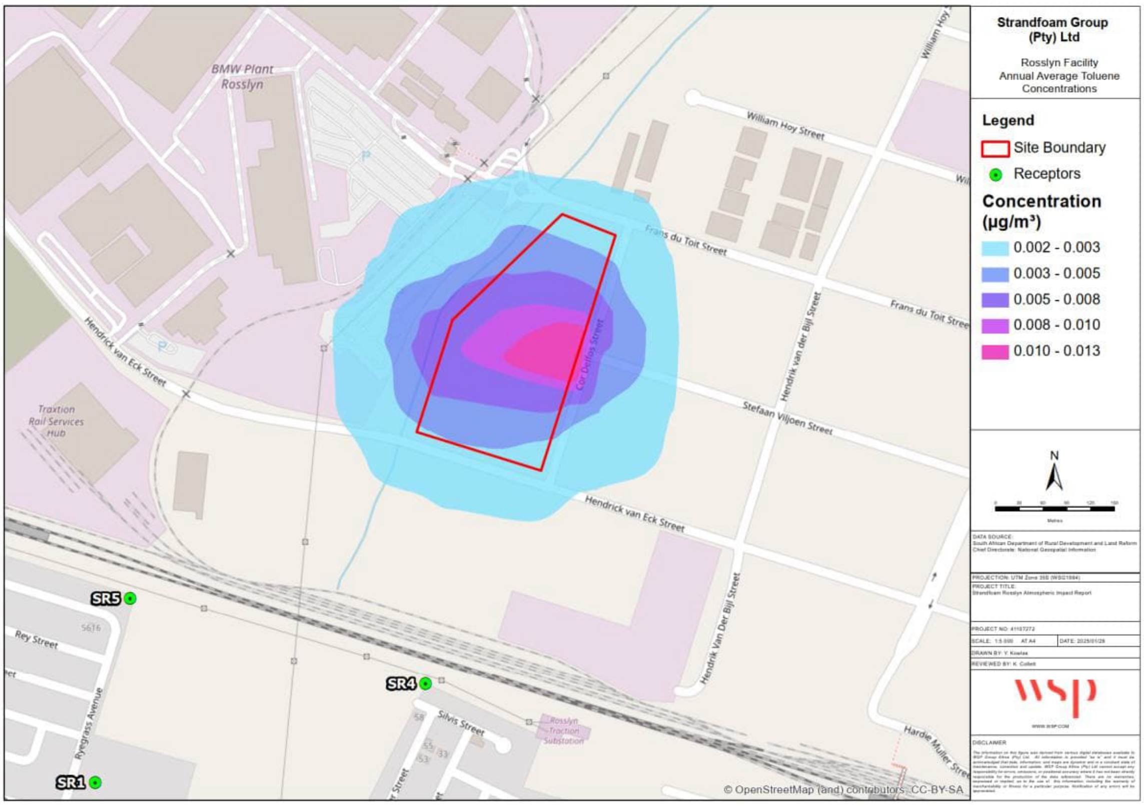


Figure 6-21: Period average toluene

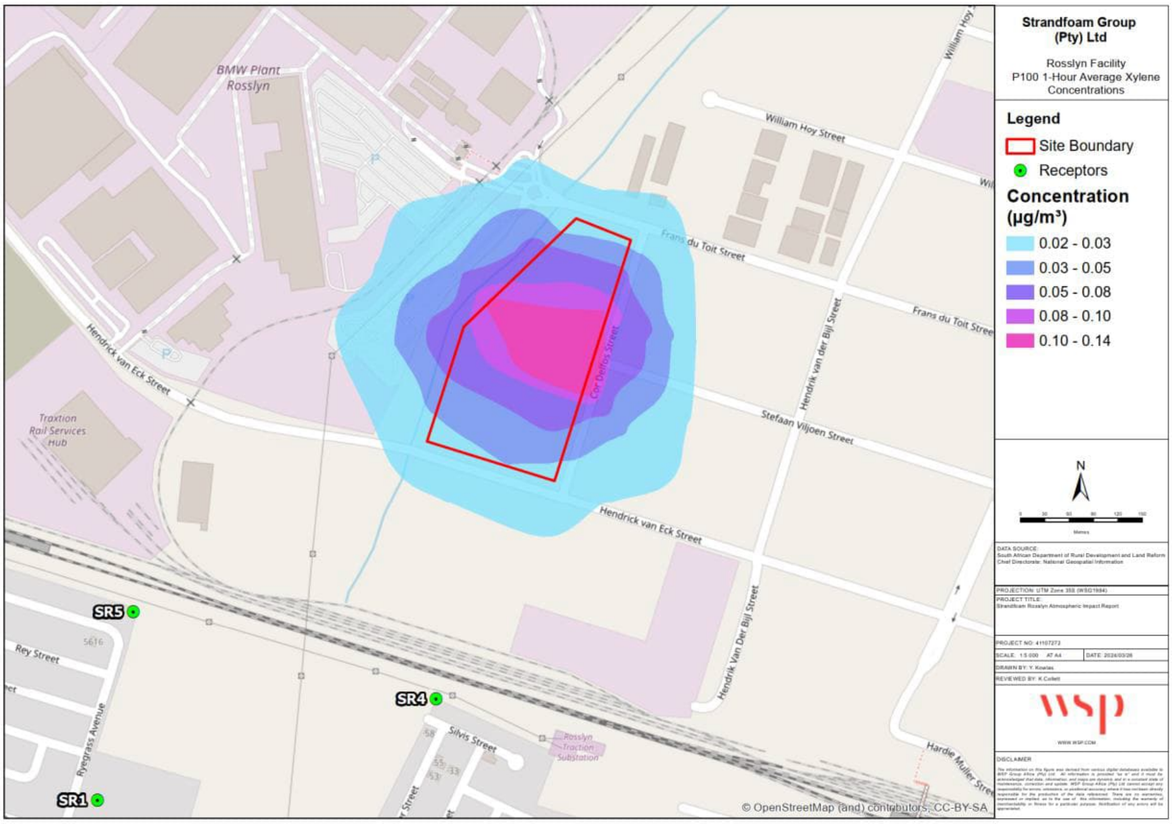


Figure 6-22: P100 1-hour average xylene

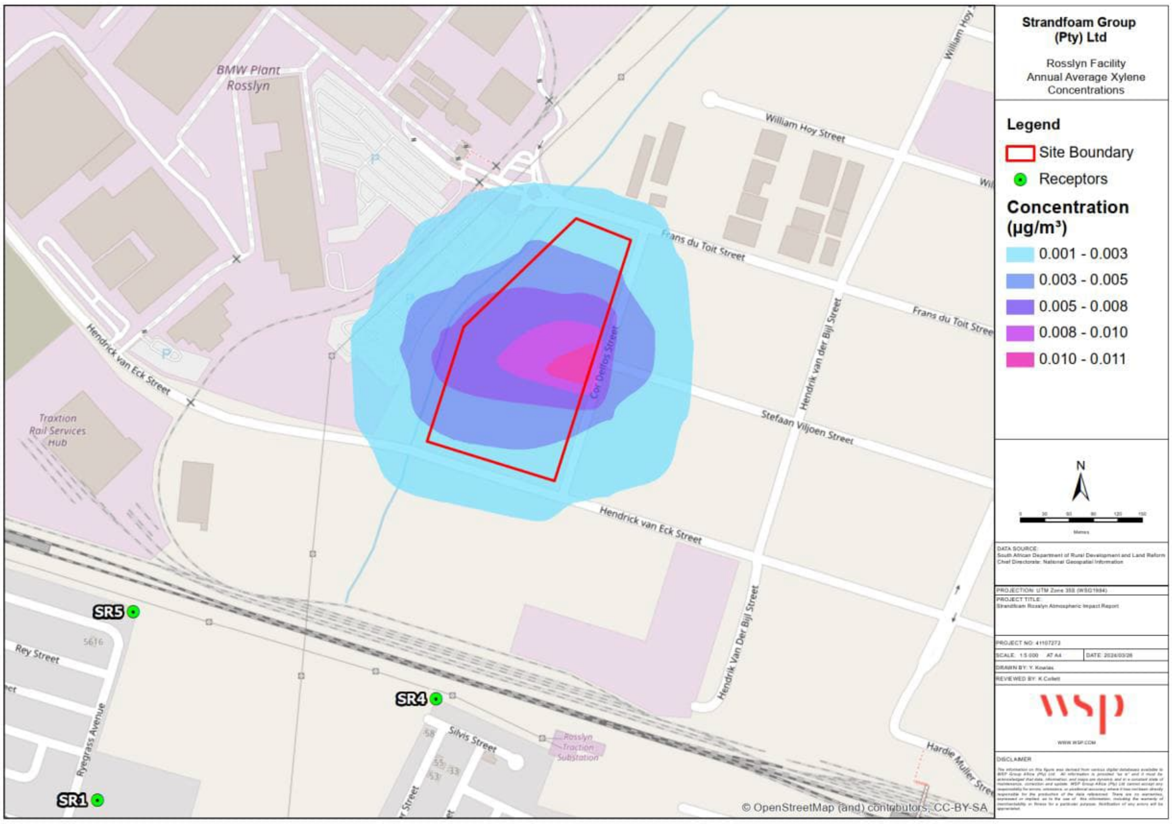


Figure 6-23: Period average xylene

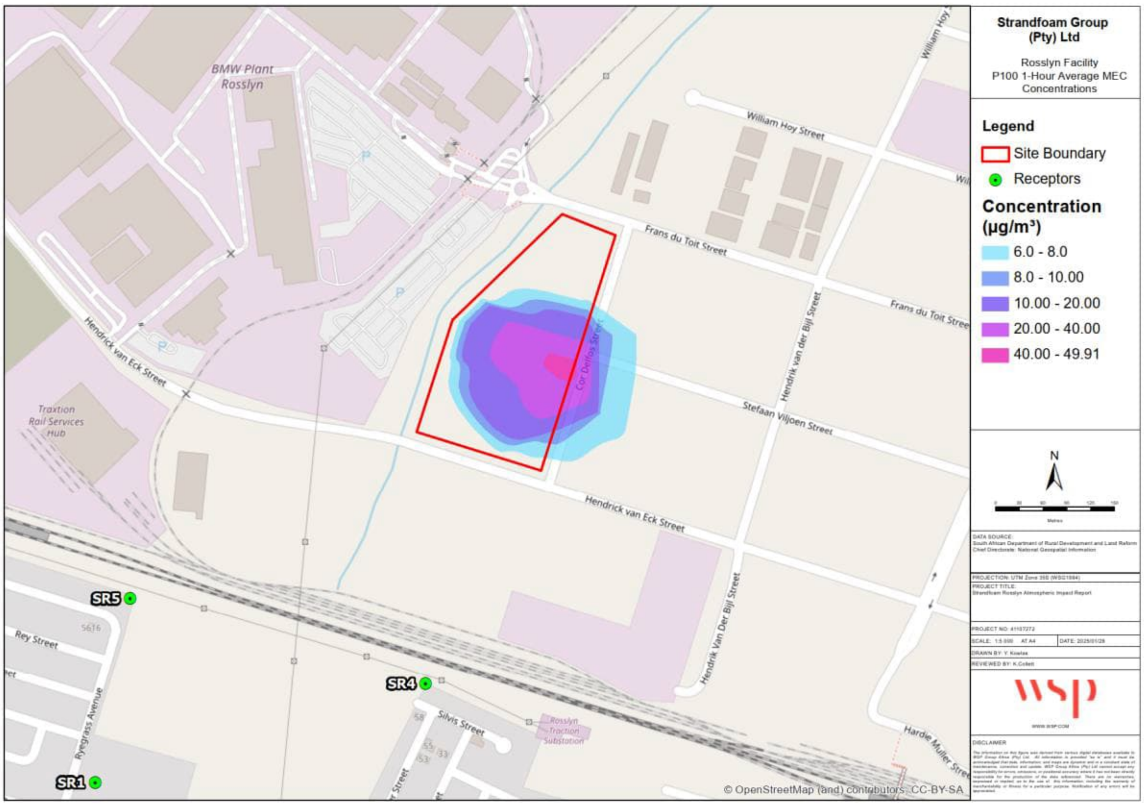


Figure 6-24: P100 1-hour average MEC

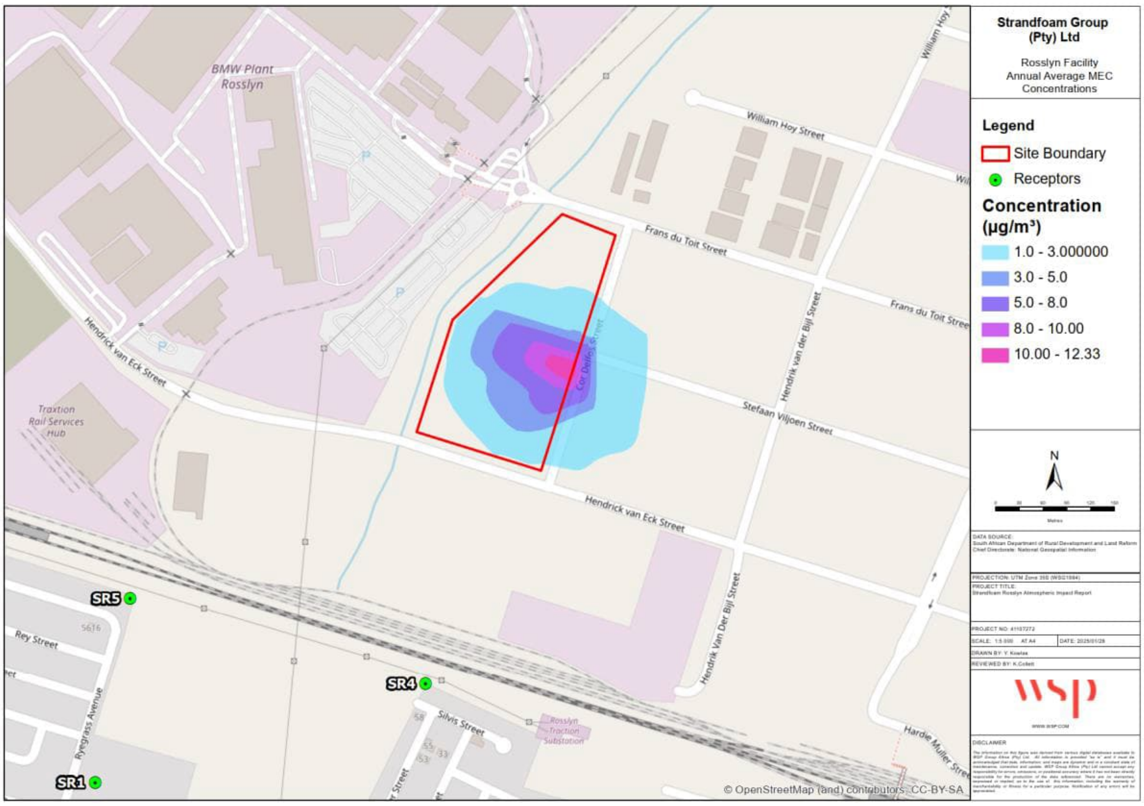


Figure 6-25: Period average MEC

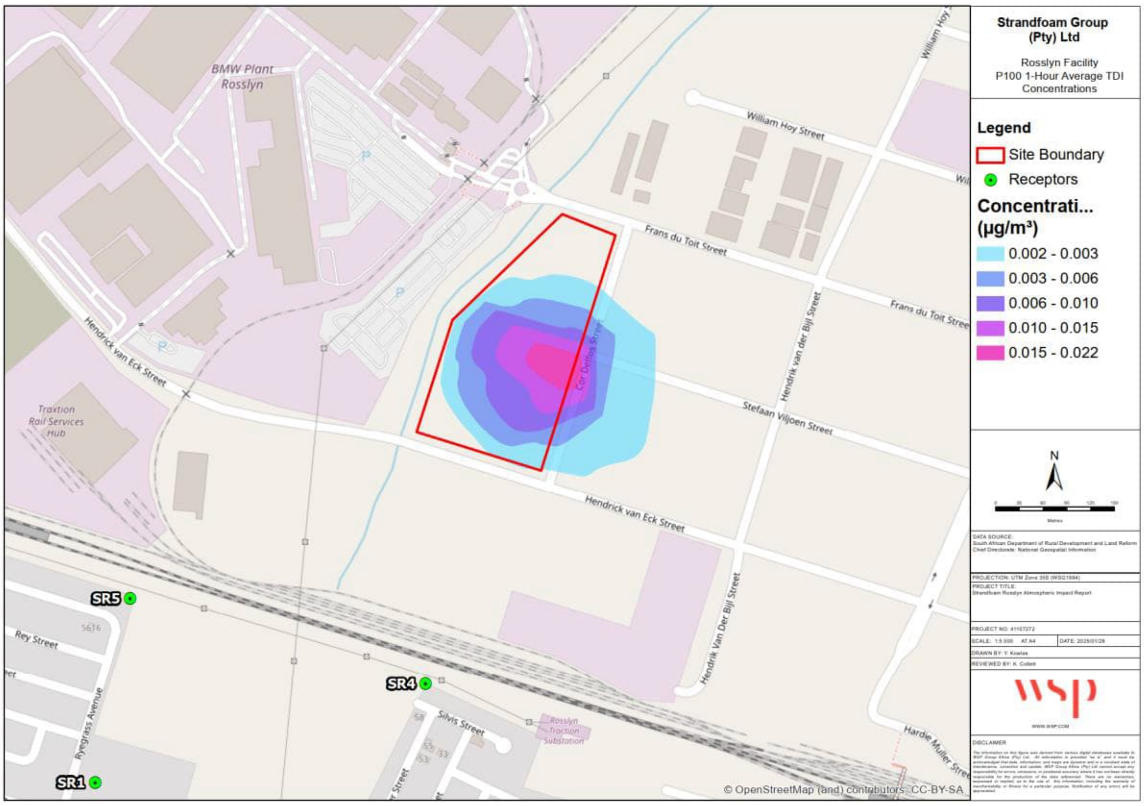


Figure 6-26: P100 1-hour average TDI

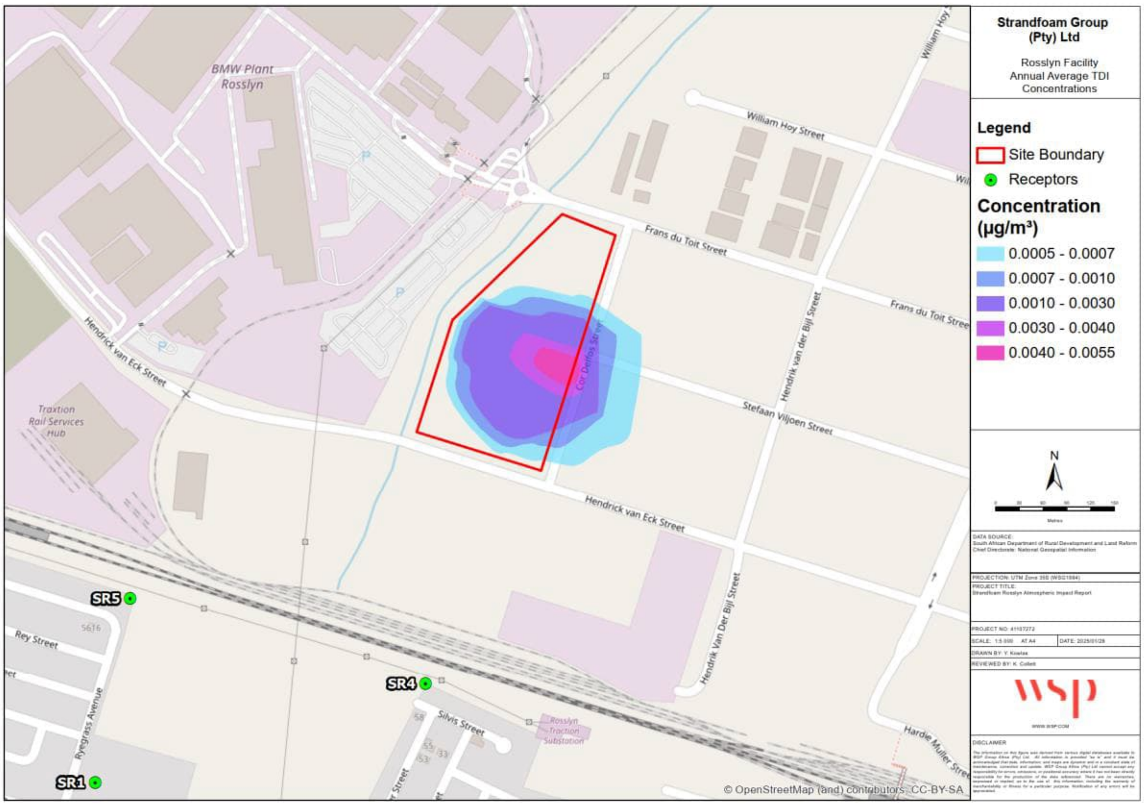


Figure 6-27: Period average TDI

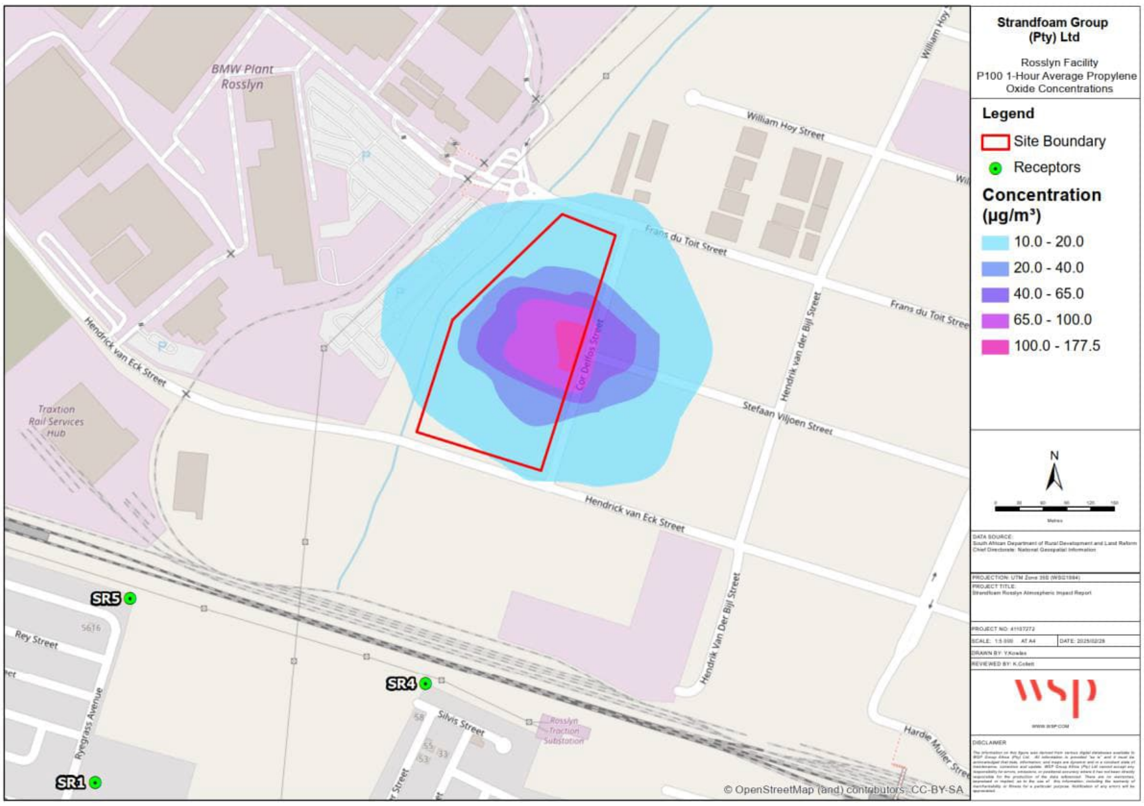


Figure 6-28: P100 1-hour average propylene oxide

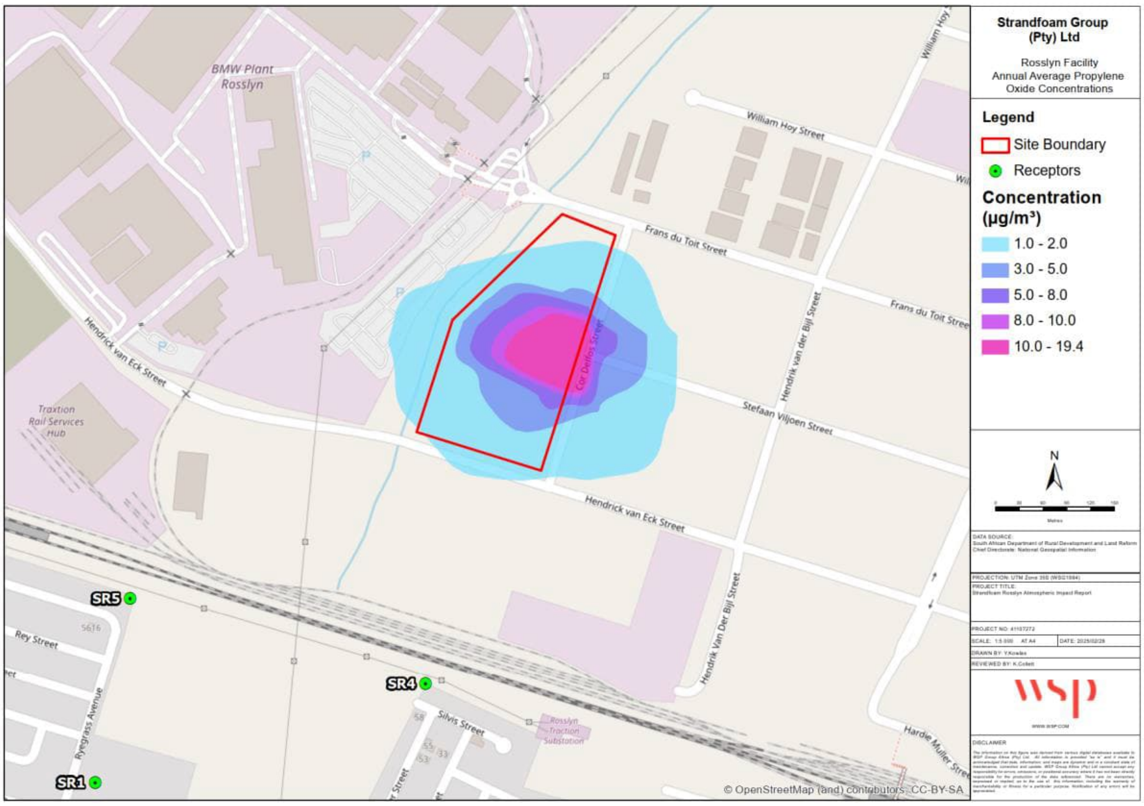


Figure 6-29: Period average propylene oxide

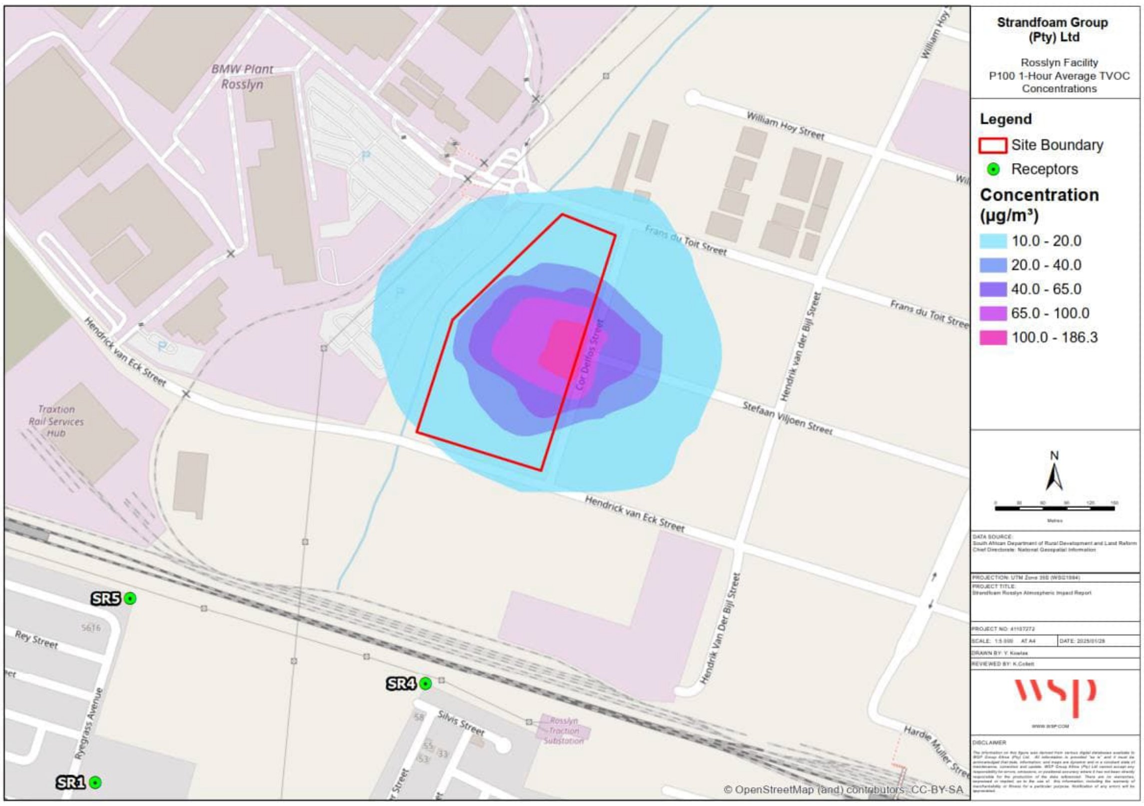


Figure 6-30: P100 1-hour average TVOC

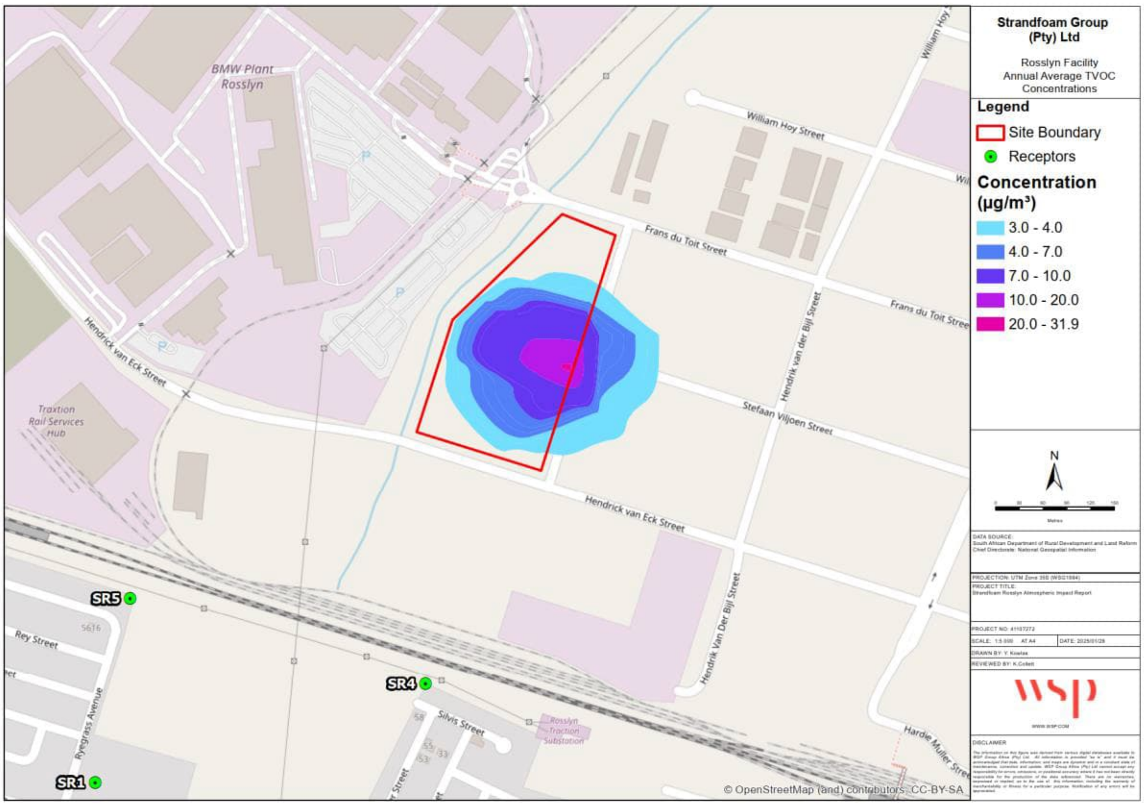


Figure 6-31: Period average TVOC

6.2 ANALYSIS OF EMISSIONS' IMPACT ON THE ENVIRONMENT

The following sections analyse the potential impacts associated with air pollution on the surrounding environment.

6.2.1 EFFECTS ON VEGETATION

Air pollution in South Africa was first identified as a potential threat to vegetation in 1988 (Tyson *et al.*, 1988). The commercial forests of the eastern escarpment were highlighted as a threatened resource due to their proximity to the heavily industrialised Highveld. Marshal *et al.* (1998) also identified concerns around the potential impacts on crop yields on the Highveld. Air pollutants that could impact on vegetation include PM, SO_2, O_3, NO_x and hydrogen fluoride (HF).

The effects of pollution on plants include mottled foliage, 'burning' at leaf tips or margins, twig dieback, stunted growth, premature leaf drop, delayed maturity, abortion or early drop of blossoms, and reduced yield or quality. In general, the visible injury to plants is of three types: (1) collapse of leaf tissue with the development of necrotic patterns, (2) yellowing or other colour changes, and (3) alterations in growth or premature loss of foliage (Sikora and Chappelka, 2004). Factors that govern the extent of damage and the region where air pollution is a problem are (1) type and concentration of pollutants, (2) distance from the source, (3) length of exposure, and (4) meteorological conditions. Other important factors are city size and location, land topography, soil moisture and nutrient supply, maturity of plant tissues, time of year, and species and variety of plants. A soil moisture deficit or extremes of temperature, humidity, and light often alter a plant's response to an air pollutant (Sikora and Chappelka, 2004).

6.2.2 EFFECTS ON ANIMALS

Air pollution is a recognized health hazard to domestic animals and wildlife. Industrial air pollutants effect both wild birds and mammals, causing notable decreases in local populations (Newman, 1979). The major effects include direct mortality, debilitating injury and disease, stress, anaemia, and bioaccumulation (Newman, 1979). Certain air pollutants are also known to cause variation in the distribution of certain wildlife species (Schreiber, and Newman, 1988). Animals are typically exposed to air pollution through a) inhalation of gases or small particles, b) ingestion of particles suspended in food or water, or c) absorption of gases through the skin (Burdo, 2018). Soft-bodied invertebrates (such as earthworms), or animals with thin, moist skin (such as amphibians) are the most susceptible to absorption of pollutants. Individual responses to pollutants are dependent on the type of pollutant involved, the duration and time of exposure, and the concentration taken up by the animal (Wong and Candolin, 2015). The individual's age, sex, health, and reproductive condition also determines its response. There is much variability observed between animal classes, species, and even genotypes, in terms of the level of tolerance to a specific pollutant (Wong and Candolin, 2015).

6.3 ASSUMPTIONS AND LIMITATIONS

Various assumptions were made in the compilation of this AIR. When possible, an environmentally conservative approach was taken to ensure emission rate calculations and model predictions represent a worst-case scenario. The assumptions and limitations underlying the study methodology are as follows:

GENERAL

- Unless otherwise stated, operational information for the Rosslyn facility was provided by Strandfoam. Any errors, limitations or assumptions inherent in these datasets extend to this study.
- Emission source IDs used in this assessment have been independently assigned by WSP to assist with the interpretation of data and findings presented by this AIR.

EMISSIONS INVENTORY

BOILERS

- The Rosslyn facility currently operates a single boiler (Boiler 1 – Chipfoam 1 & 2) of 0.392 MW capacity, which generates steam during chipfoam production. Strandfoam plans to install an additional boiler of <10 MW in 2025. With the addition of the new boiler (Boiler 2 – Chipfoam 3) the cumulative heat input of all boilers will be < 10MW.
- Emission rates for the Boiler 1 - Chipfoam 1 & 2 and Boiler 2 – Chipfoam 3 were based on a diesel consumption rate of 78,343 litres per year.
- In the absence of emission rates for the Chipfoam boiler, use was made of the NAEIS guidelines emission factor for small boilers with a design capacity of less than 10 MW.

STORAGE TANKS

- Emission rates for bulk storage tanks were simulated using the USEPA TANKS 4.0.d emissions estimation model as recommended by the *Modelling Regulations*.

- The TANKS model requires local meteorological input at an annual and monthly resolution. WRF pre-processed data was sourced from Lakes Environmental for use in the TANKS model. This data was utilised as it represented the most complete dataset for all required variables.
- When required, conflicting or missing parameters for storage tanks have been calculated using Client provided tank height and diameter dimensions as follows:
  - Tank working volumes have been calculated based on an assumed maximum liquid height of 90%.
  - Average liquid heights were assumed to be 50% of the maximum liquid height.
  - Net throughput of each tank was based on total product consumption rates, the number of duplicate tanks (applicable to the polyol, TDI and diesel tanks only) and proportional to each tank's calculated working volume.
- Gas exit velocity for diesel (EU026 -EU028 and EU 035) and petrol (EU036) tank vents was assumed to be 0.001 m/s in line with the *Modelling Regulations*.
- EU011 and EU037 are process tanks used solely for decanting drums or intermediate bulk containers. Emissions from such are therefore accounted for in the related storage tanks.
- Tank EU034 is not yet operational, so there is currently no throughput. Additionally, due to the tank's relatively small size compared to other tanks, any potential emissions are expected to be minimal. This tank was not simulated in the dispersion model.
- Tank EU035 turn overs and net throughput was assumed to the same as Tank EU028, based on the same tank design specifications.
- The turnover for Tank EU036 was calculated from the USEPA TANKS 4.0d model.
- Where actual storage tank shell colours are not available in TANKS 4.0d, colour substitutes where applied.
- Where possible, speciated VOCs were modelled for petroleum distillate products (diesel and petrol) using the default speciation profiles preloaded to TANKS.
- No vapour recovery units or emissions control equipment are assumed to be used.
- Melafine was assumed to have the same chemical properties as melamine (Ref. https://thechemco.com/chemical/melamine/)
  - Additionally, where a tank stored melafine or $CaCO_3$, and polyol, the chemical with the higher vapour pressure was simulated in the TANKS 4.0d model, which in both cases is polyol.

REBOND MACHINES

- Rebond dust extrusion machines as indicated by Strandfoam are planned to be installed in 2026, 2027 and 2028, as such these machines are not assessed in the AIR.
  - Furthermore, during the review by WSP there are no emissions factors available for Rebond machines and as such any related emissions cannot be quantified.

EXTRUSION VENTS

- All extrusion vent information was extracted from the Skyside Test Report: STR003, dated 07 November 2022.

DISPERSION MODEL

- Building downwash effects have been accounted for in the dispersion model using building location and building shape visible on Google Earth.
- Area source dimensions for the outside polyol storage area are based on tank dimensions.

- In line with the *Modelling Regulations*, above ground outdoor storage tanks (where applicable) where simulated as point sources with the vent located centrally.
- Indoor tank emissions were summed and modelled as a volume source.
- Volume source dimensions for indoor raw material storage are based on tank dimensions.
- Variable emission rates have been applied as follows:
  - Storage tanks: Emissions are considered continuous (i.e., 24 hours per day for 365 days per year).
  - Extrusion vents: The polyurethane foam block manufacturing process operates for 1 hour per day over 153 days of the year. As a worst-case assessment, this was run as 1 hour a day (10:00 -11:00) every weekday in the dispersion model.
  - Chipfoam Boilers: The chipfoam block production process operates for 9.5 hours per day over 224 days of the year. This was run as 9.5 hours a day (07:30 – 17:00) every weekday in the dispersion model.

7 COMPLAINTS

There have been no air quality related complaints received in the last two years, as confirmed by Strandfoam.

8 CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

There are currently no planned air quality management interventions for the Rosslyn facility.

9 COMPLIANCE AND ENFORCEMENT

There have been no air quality compliance and enforcement actions undertaken against the facility in the last five years.

10 ADDITIONAL INFORMATION

There is no additional information to supply in relation to this AIR.

11 FORMAL DECLARATIONS

11.1 ANNEXURE A: DECLARATION OF ACCURACY OF INFORMATION

DECLARATION OF ACCURACY OF INFORMATION - APPLICANT

Name of Enterprise: Strandfoam Group (Pty) Ltd

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of section 30 of the Act.

I, WILLEM HENDRIK VAN DER WESTHUIZEN (duly authorised), declare that the information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1)(g) of this Act.

Signed at STRAND on this 12th day of FEBRUARY 2025

SIGNATURE

CEO

CAPACITY OF SIGNATORY

11.2 ANNEXURE B: DECLARATION OF INDEPENDENCE OF PRACTITIONER

DECLARATION OF INDEPENDENCE - PRACTITIONER

Name of Practitioner: Yakeen Kowlas

Name of Registration Body: South African Council for Natural Scientific Professions (SACNASP)

Professional Registration No: 155605

Declaration of independence and accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act.

I, Yakeen Kowlas, declare that I am independent of the applicant. I have the necessary expertise to conduct the assessments required for the report and will perform the work relating the application in an objective manner, even if this results in views and findings that are not favourable to the applicant. I will disclose to the applicant and the air quality officer all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the air quality officer, The information provided in this atmospheric impact report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1) (g) of this Act.

Signed at Midrand on this 19th day of February 2025 .

Yakeen Kowlas
2025.02.19 15:02:04
+02'00'

SIGNATURE

Principal Consultant at WSP

CAPACITY OF SIGNATORY

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APPENDIX

A TANKS MODEL OUTPUTS

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_01
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Ladderberg Poly 1-6 Polyol

Tank Dimensions

Shell Length (ft):	17.81
Diameter (ft):	7.61
Volume (gallons):	5 748.38
Turnovers:	3.00
Net Throughput(gal/yr):	17 245.14
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_01 - Horizontal Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Polyol	All	74.75	62.93	86.57	69.90	0.1987	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_01 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	35.5343
Vapor Space Volume (cu ft):	515.9688
Vapor Density (lb/cu ft):	0.0020
Vapor Space Expansion Factor:	0.0976
Vented Vapor Saturation Factor:	0.9615
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	515.9688
Tank Diameter (ft):	7.6100
Effective Diameter (ft):	13.1398
Vapor Space Outage (ft):	3.8050
Tank Shell Length (ft):	17.8100
Vapor Density	
Vapor Density (lb/cu ft):	0.0020
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0976
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9615
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.1987
Vapor Space Outage (ft):	3.8050
Working Losses (lb):	4.7357
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Annual Net Throughput (gal/yr.):	17 245.1400
Annual Turnovers:	3.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	7.6100
Working Loss Product Factor:	1.0000
Total Losses (lb):	40.2700

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_01 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	4.74	35.53	40.27

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_02
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Laaderberg Filla CaCO3 & Polyol
Tank Dimensions	
Shell Length (ft):	18.04
Diameter (ft):	7.61
Volume (gallons):	5 822.35
Turnovers:	16.50
Net Throughput(gal/yr):	96 068.78
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_02 - Horizontal Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Polyol	All	74.75	62.93	86.57	69.90	0.1987	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_02 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	35.9932
Vapor Space Volume (cu ft):	522.6321
Vapor Density (lb/cu ft):	0.0020
Vapor Space Expansion Factor:	0.0976
Vented Vapor Saturation Factor:	0.9615
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	522.6321
Tank Diameter (ft):	7.6100
Effective Diameter (ft):	13.2244
Vapor Space Outage (ft):	3.8050
Tank Shell Length (ft):	18.0400
Vapor Density	
Vapor Density (lb/cu ft):	0.0020
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0976
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9615
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.1987
Vapor Space Outage (ft):	3.8050
Working Losses (lb):	26.3816
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Annual Net Throughput (gal/yr.):	96 068.7750
Annual Turnovers:	16.5000
Turnover Factor:	1.0000
Tank Diameter (ft):	7.6100
Working Loss Product Factor:	1.0000
Total Losses (lb):	62.3748

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_02 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	26.38	35.99	62.37

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_03
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Vertical Fixed Roof Tank
Description:	Annamarie 9-11 Polyol

Tank Dimensions

Shell Height (ft):	13.78
Diameter (ft):	12.80
Liquid Height (ft) :	12.40
Avg. Liquid Height (ft):	6.20
Volume (gallons):	11 930.01
Turnovers:	3.00
Net Throughput(gal/yr):	35 790.03
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	12.80

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_03 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Polyol	All	77.35	63.68	91.02	70.80	0.2439	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_03 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	97.6428
Vapor Space Volume (cu ft):	1 088.3669
Vapor Density (lb/cu ft):	0.0025
Vapor Space Expansion Factor:	0.1110
Vented Vapor Saturation Factor:	0.9014
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1 088.3669
Tank Diameter (ft):	12.8000
Vapor Space Outage (ft):	8.4580
Tank Shell Height (ft):	13.7800
Average Liquid Height (ft):	6.2000
Roof Outage (ft):	0.8780
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.8780
Dome Radius (ft):	12.8000
Shell Radius (ft):	6.4000
Vapor Density	
Vapor Density (lb/cu ft):	0.0025
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2439
Daily Avg. Liquid Surface Temp. (deg. R):	537.0199
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	530.4700
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1110
Daily Vapor Temperature Range (deg. R):	54.6947
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2439
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	537.0199
Daily Min. Liquid Surface Temp. (deg R):	523.3463
Daily Max. Liquid Surface Temp. (deg R):	550.6936
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9014
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.2439
Vapor Space Outage (ft):	8.4580
Working Losses (lb):	12.0632
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2439
Annual Net Throughput (gal/yr.):	35 790.0300
Annual Turnovers:	3.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	11 930.0100
Maximum Liquid Height (ft):	12.4000
Tank Diameter (ft):	12.8000
Working Loss Product Factor:	1.0000
Total Losses (lb):	109.7059

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_03 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	12.06	97.64	109.71

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_04
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Vertical Fixed Roof Tank
Description:	New Bulk 1-2 tanks Polyol
Tank Dimensions	
Shell Height (ft):	19.69
Diameter (ft):	10.70
Liquid Height (ft) :	17.72
Avg. Liquid Height (ft):	8.86
Volume (gallons):	11 906.23
Turnovers:	3.00
Net Throughput(gal/yr):	35 718.69
Is Tank Heated (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Roof Color/Shade:	Aluminum/Specular
Roof Condition:	Good
Roof Characteristics	
Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	10.70
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_04 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Polyol	All	74.75	62.93	86.57	69.90	0.1987	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_04 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	66.3956
Vapor Space Volume (cu ft):	1 039.8302
Vapor Density (lb/cu ft):	0.0020
Vapor Space Expansion Factor:	0.0976
Vented Vapor Saturation Factor:	0.8914
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1 039.8302
Tank Diameter (ft):	10.7000
Vapor Space Outage (ft):	11.5639
Tank Shell Height (ft):	19.6900
Average Liquid Height (ft):	8.8600
Roof Outage (ft):	0.7339
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.7339
Dome Radius (ft):	10.7000
Shell Radius (ft):	5.3500
Vapor Density	
Vapor Density (lb/cu ft):	0.0020
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Tank Paint Solar Absorptance (Roof):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0976
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.8914
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.1987
Vapor Space Outage (ft):	11.5639
Working Losses (lb):	9.8088
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Annual Net Throughput (gal/yr.):	35 718.6900
Annual Turnovers:	3.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	11 906.2300
Maximum Liquid Height (ft):	17.7200
Tank Diameter (ft):	10.7000
Working Loss Product Factor:	1.0000
Total Losses (lb):	76.2044

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_04 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	9.81	66.40	76.20

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_05
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Laaderberg TDI (A-D)
Tank Dimensions	
Shell Length (ft):	16.60
Diameter (ft):	8.30
Volume (gallons):	6 802.43
Turnovers:	8.95
Net Throughput(gal/yr):	60 881.75
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_05 - Horizontal Tank
Rosslyn, Gauteng

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Toluene Diisocyanate	All	74.75	62.93	86.57	69.90	0.0003	0.0002	0.0006	174.1600			174.16	Option 1: VP70 = .00024 VP80 = .00041

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_05 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	0.1704
Vapor Space Volume (cu ft):	572.0770
Vapor Density (lb/cu ft):	0.0000
Vapor Space Expansion Factor:	0.0838
Vented Vapor Saturation Factor:	0.9999
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	572.0770
Tank Diameter (ft):	8.3000
Effective Diameter (ft):	13.2482
Vapor Space Outage (ft):	4.1500
Tank Shell Length (ft):	16.6000
Vapor Density	
Vapor Density (lb/cu ft):	0.0000
Vapor Molecular Weight (lb/lb-mole):	174.1600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0003
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0838
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.0004
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0003
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0006
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9999
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0003
Vapor Space Outage (ft):	4.1500
Working Losses (lb):	0.0810
Vapor Molecular Weight (lb/lb-mole):	174.1600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0003
Annual Net Throughput (gal/yr.):	60 881.7485
Annual Turnovers:	8.9500
Turnover Factor:	1.0000
Tank Diameter (ft):	8.3000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.2514

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_05 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Toluene Diisocyanate	0.08	0.17	0.25

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_06
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Annamarie Mixing (12-13) Polyol

Tank Dimensions

Shell Length (ft):	18.14
Diameter (ft):	5.84
Volume (gallons):	3 444.80
Turnovers:	3.00
Net Throughput(gal/yr):	10 334.40
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_06 - Horizontal Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Polyol	All	74.75	62.93	86.57	69.90	0.1987	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_06 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	21.5073
Vapor Space Volume (cu ft):	309.4947
Vapor Density (lb/cu ft):	0.0020
Vapor Space Expansion Factor:	0.0976
Vented Vapor Saturation Factor:	0.9702
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	309.4947
Tank Diameter (ft):	5.8400
Effective Diameter (ft):	11.6169
Vapor Space Outage (ft):	2.9200
Tank Shell Length (ft):	18.1400
Vapor Density	
Vapor Density (lb/cu ft):	0.0020
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0976
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9702
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.1987
Vapor Space Outage (ft):	2.9200
Working Losses (lb):	2.8380
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Annual Net Throughput (gal/yr.):	10 334.4000
Annual Turnovers:	3.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	5.8400
Working Loss Product Factor:	1.0000
Total Losses (lb):	24.3453

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_06 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	2.84	21.51	24.35

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_07
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Vertical Fixed Roof Tank
Description:	Laaderberg MEC

Tank Dimensions

Shell Height (ft):	7.87
Diameter (ft):	3.84
Liquid Height (ft) :	7.09
Avg. Liquid Height (ft):	3.54
Volume (gallons):	573.25
Turnovers:	13.50
Net Throughput(gal/yr):	7 240.15
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	3.84

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_07 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Methylene chloride	All	77.35	63.68	91.02	70.80	8.3643	6.1410	11.2067	84.9400			84.94	Option 2: A=7.409, B=1325.9, C=252.6

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_07 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	990.5280
Vapor Space Volume (cu ft):	53.1968
Vapor Density (lb/cu ft):	0.1233
Vapor Space Expansion Factor:	1.2564
Vented Vapor Saturation Factor:	0.3293
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	53.1968
Tank Diameter (ft):	3.8400
Vapor Space Outage (ft):	4.5934
Tank Shell Height (ft):	7.8700
Average Liquid Height (ft):	3.5400
Roof Outage (ft):	0.2634
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.2634
Dome Radius (ft):	3.8400
Shell Radius (ft):	1.9200
Vapor Density	
Vapor Density (lb/cu ft):	0.1233
Vapor Molecular Weight (lb/lb-mole):	84.9400
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	8.3643
Daily Avg. Liquid Surface Temp. (deg. R):	537.0199
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	530.4700
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	1.2564
Daily Vapor Temperature Range (deg. R):	54.6947
Daily Vapor Pressure Range (psia):	5.0656
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	8.3643
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	6.1410
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	11.2067
Daily Avg. Liquid Surface Temp. (deg R):	537.0199
Daily Min. Liquid Surface Temp. (deg R):	523.3463
Daily Max. Liquid Surface Temp. (deg R):	550.6936
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.3293
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	8.3643
Vapor Space Outage (ft):	4.5934
Working Losses (lb):	122.4734
Vapor Molecular Weight (lb/lb-mole):	84.9400
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	8.3643
Annual Net Throughput (gal/yr.):	7 240.1475
Annual Turnovers:	13.5000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	573.2500
Maximum Liquid Height (ft):	7.0900
Tank Diameter (ft):	3.8400
Working Loss Product Factor:	1.0000
Total Losses (lb):	1 113.0014

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_07 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Methylene chloride	122.47	990.53	1 113.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_08
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Vertical Fixed Roof Tank
Description:	Polyol
Tank Dimensions	
Shell Height (ft):	12.47
Diameter (ft):	9.84
Liquid Height (ft) :	11.22
Avg. Liquid Height (ft):	5.61
Volume (gallons):	6 386.24
Turnovers:	3.00
Net Throughput(gal/yr):	18 126.94
Is Tank Heated (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Aluminum/Specular
Shell Condition	Good
Roof Color/Shade:	Aluminum/Specular
Roof Condition:	Good
Roof Characteristics	
Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	9.84
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_08 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Polyol	All	74.75	62.93	86.57	69.90	0.1987	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_08 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	38.0262
Vapor Space Volume (cu ft):	573.0062
Vapor Density (lb/cu ft):	0.0020
Vapor Space Expansion Factor:	0.0976
Vented Vapor Saturation Factor:	0.9265
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	573.0062
Tank Diameter (ft):	9.8400
Vapor Space Outage (ft):	7.5349
Tank Shell Height (ft):	12.4700
Average Liquid Height (ft):	5.6100
Roof Outage (ft):	0.6749
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.6749
Dome Radius (ft):	9.8400
Shell Radius (ft):	4.9200
Vapor Density	
Vapor Density (lb/cu ft):	0.0020
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Daily Avg. Liquid Surface Temp. (deg. R):	534.4227
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	529.5700
Tank Paint Solar Absorptance (Shell):	0.3900
Tank Paint Solar Absorptance (Roof):	0.3900
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0976
Daily Vapor Temperature Range (deg. R):	47.2757
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	534.4227
Daily Min. Liquid Surface Temp. (deg R):	522.6038
Daily Max. Liquid Surface Temp. (deg R):	546.2417
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9265
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.1987
Vapor Space Outage (ft):	7.5349
Working Losses (lb):	4.9779
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.1987
Annual Net Throughput (gal/yr.):	18 126.9389
Annual Turnovers:	3.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	6 386.2400
Maximum Liquid Height (ft):	11.2200
Tank Diameter (ft):	9.8400
Working Loss Product Factor:	1.0000
Total Losses (lb):	43.0040

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_08 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	4.98	38.03	43.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_09
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Diesel Underground Tanks
Tank Dimensions	
Shell Length (ft):	14.62
Diameter (ft):	6.56
Volume (gallons):	3 698.41
Turnovers:	2.30
Net Throughput(gal/yr):	8 599.10
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	Y
Paint Characteristics	
Shell Color/Shade:	
Shell Condition	
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_09 - Horizontal Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	68.00	68.00	68.00	67.56	0.0085	0.0085	0.0085	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
1,2,4-Trimethylbenzene						0.0280	0.0280	0.0280	120.1900	0.0100	0.0476	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.4520	1.4520	1.4520	78.1100	0.0000	0.0020	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.1426	0.1426	0.1426	106.1700	0.0001	0.0032	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						2.3473	2.3473	2.3473	86.1700	0.0000	0.0004	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.4216	0.4216	0.4216	92.1300	0.0003	0.0230	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						0.0073	0.0068	0.0073	134.4658	0.9866	0.8652	189.60	
Xylene (-m)						0.1191	0.1191	0.1191	106.1700	0.0029	0.0588	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_09 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
No Standing Losses: Underground Tank	
Working Losses (lb):	0.2262
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0085
Annual Net Throughput (gal/yr.):	8 599.1000
Annual Turnovers:	2.3000
Turnover Factor:	1.0000
Tank Diameter (ft):	6.5600
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.2262

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_09 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.23	0.00	0.23
Hexane (-n)	0.00	0.00	0.00
Benzene	0.00	0.00	0.00
Toluene	0.01	0.00	0.01
Ethylbenzene	0.00	0.00	0.00
Xylene (-m)	0.01	0.00	0.01
1,2,4-Trimethylbenzene	0.01	0.00	0.01
Unidentified Components	0.20	0.00	0.20

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	GP_10
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Diesel Tank - Boiler
Tank Dimensions	
Shell Length (ft):	7.05
Diameter (ft):	3.77
Volume (gallons):	560.04
Turnovers:	36.96
Net Throughput(gal/yr):	20 697.40
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Gray/Light
Shell Condition	Good
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_10 - Horizontal Tank
Rosslyn, Gauteng

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	77.35	63.68	91.02	70.80	0.0112	0.0074	0.0166	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
1,2,4-Trimethylbenzene						0.0398	0.0236	0.0648	120.1900	0.0100	0.0514	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.8543	1.2921	2.6041	78.1100	0.0000	0.0019	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.1938	0.1232	0.2963	106.1700	0.0001	0.0033	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						2.9531	2.1038	4.0632	86.1700	0.0000	0.0004	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.5548	0.3698	0.8121	92.1300	0.0003	0.0229	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						0.0095	0.0081	0.0084	134.6111	0.9866	0.8594	189.60	
Xylene (-m)						0.1623	0.1027	0.2493	106.1700	0.0029	0.0607	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_10 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	0.4520
Vapor Space Volume (cu ft):	50.1259
Vapor Density (lb/cu ft):	0.0003
Vapor Space Expansion Factor:	0.0978
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	50.1259
Tank Diameter (ft):	3.7700
Effective Diameter (ft):	5.8188
Vapor Space Outage (ft):	1.8850
Tank Shell Length (ft):	7.0500
Vapor Density	
Vapor Density (lb/cu ft):	0.0003
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0112
Daily Avg. Liquid Surface Temp. (deg. R):	537.0199
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	530.4700
Tank Paint Solar Absorptance (Shell):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0978
Daily Vapor Temperature Range (deg. R):	54.6947
Daily Vapor Pressure Range (psia):	0.0092
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0112
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0074
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0166
Daily Avg. Liquid Surface Temp. (deg R):	537.0199
Daily Min. Liquid Surface Temp. (deg R):	523.3463
Daily Max. Liquid Surface Temp. (deg R):	550.6936
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0112
Vapor Space Outage (ft):	1.8850
Working Losses (lb):	0.7023
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0112
Annual Net Throughput (gal/yr.):	20 697.4000
Annual Turnovers:	36.9600
Turnover Factor:	0.9784
Tank Diameter (ft):	3.7700
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.1543

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_10 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.70	0.45	1.15
Hexane (-n)	0.00	0.00	0.00
Benzene	0.00	0.00	0.00
Toluene	0.02	0.01	0.03
Ethylbenzene	0.00	0.00	0.00
Xylene (-m)	0.04	0.03	0.07
1,2,4-Trimethylbenzene	0.04	0.02	0.06
Unidentified Components	0.60	0.39	0.99

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_12
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Horizontal Tank
Description:	Ladderberg Melafine Polyol

Tank Dimensions

Shell Length (ft):	6.23
Diameter (ft):	5.87
Volume (gallons):	1 196.70
Turnovers:	1.00
Net Throughput(gal/yr):	1 196.70
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_12 - Horizontal Tank
Rosslyn, Gauteng

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Polyol	All	79.77	64.37	95.18	71.64	0.2861	0.1160	0.2900	58.0419			3 000.00	Option 1: VP70 = .11603 VP80 = .29

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_12 - Horizontal Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	13.2833
Vapor Space Volume (cu ft):	107.3877
Vapor Density (lb/cu ft):	0.0029
Vapor Space Expansion Factor:	0.1234
Vented Vapor Saturation Factor:	0.9574
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	107.3877
Tank Diameter (ft):	5.8700
Effective Diameter (ft):	6.8254
Vapor Space Outage (ft):	2.9350
Tank Shell Length (ft):	6.2300
Vapor Density	
Vapor Density (lb/cu ft):	0.0029
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2861
Daily Avg. Liquid Surface Temp. (deg. R):	539.4440
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	531.3100
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1234
Daily Vapor Temperature Range (deg. R):	61.6190
Daily Vapor Pressure Range (psia):	0.1740
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2861
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.1160
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.2900
Daily Avg. Liquid Surface Temp. (deg R):	539.4440
Daily Min. Liquid Surface Temp. (deg R):	524.0392
Daily Max. Liquid Surface Temp. (deg R):	554.8488
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9574
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.2861
Vapor Space Outage (ft):	2.9350
Working Losses (lb):	0.4731
Vapor Molecular Weight (lb/lb-mole):	58.0419
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.2861
Annual Net Throughput (gal/yr.):	1 196.7000
Annual Turnovers:	1.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	5.8700
Working Loss Product Factor:	1.0000
Total Losses (lb):	13.7564

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_12 - Horizontal Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Polyol	0.47	13.28	13.76

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	GP_14
City:	Rosslyn
State:	Gauteng
Company:	Strandfoam Rosslyn
Type of Tank:	Vertical Fixed Roof Tank
Description:	Petrol

Tank Dimensions

Shell Height (ft):	7.05
Diameter (ft):	3.77
Liquid Height (ft) :	6.35
Avg. Liquid Height (ft):	3.17
Volume (gallons):	530.25
Turnovers:	11.14
Net Throughput(gal/yr):	5 910.80
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	3.77

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Rosslyn, Gauteng (Avg Atmospheric Pressure = 12.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

GP_14 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

		Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp	Vapor Pressure (psia)			Vapor Mol.	Liquid Mass	Vapor Mass	Mol.	Basis for Vapor Pressure
Mixture/Component	Month	Avg.	Min.	Max.	(deg F)	Avg.	Min.	Max.	Weight.	Fract.	Fract.	Weight	Calculations
Gasoline (RVP 9)	All	77.35	63.68	91.02	70.80	6.4168	4.9546	8.2044	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3
1,2,4-Trimethylbenzene						0.0398	0.0236	0.0648	120.1900	0.0250	0.0002	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.8543	1.2921	2.6041	78.1100	0.0180	0.0071	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Cyclohexane						1.9031	1.3371	2.6524	84.1600	0.0024	0.0010	84.16	Option 2: A=6.841, B=1201.53, C=222.65
Ethylbenzene						0.1938	0.1232	0.2963	106.1700	0.0140	0.0006	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						2.9531	2.1038	4.0632	86.1700	0.0100	0.0063	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Iso-butyl alcohol						0.2031	0.1136	0.3478	74.1200	0.0400	0.0017	74.12	Option 2: A=7.30636, B=1236.991, C=171.622
Isopropyl benzene						0.0897	0.0551	0.1415	120.2000	0.0050	0.0001	120.20	Option 2: A=6.93666, B=1460.793, C=207.78
Toluene						0.5548	0.3698	0.8121	92.1300	0.0700	0.0083	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						8.3695	8.2821	8.2868	66.5684	0.7456	0.9722	91.44	
Xylene (-m)						0.1623	0.1027	0.2493	106.1700	0.0700	0.0024	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

GP_14 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

Annual Emission Calcaulations	
Standing Losses (lb):	318.4866
Vapor Space Volume (cu ft):	46.1981
Vapor Density (lb/cu ft):	0.0746
Vapor Space Expansion Factor:	0.6095
Vented Vapor Saturation Factor:	0.4154
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	46.1981
Tank Diameter (ft):	3.7700
Vapor Space Outage (ft):	4.1386
Tank Shell Height (ft):	7.0500
Average Liquid Height (ft):	3.1700
Roof Outage (ft):	0.2586
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.2586
Dome Radius (ft):	3.7700
Shell Radius (ft):	1.8850
Vapor Density	
Vapor Density (lb/cu ft):	0.0746
Vapor Molecular Weight (lb/lb-mole):	67.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	6.4168
Daily Avg. Liquid Surface Temp. (deg. R):	537.0199
Daily Average Ambient Temp. (deg. F):	68.5600
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	530.4700
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1 766.4200
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.6095
Daily Vapor Temperature Range (deg. R):	54.6947
Daily Vapor Pressure Range (psia):	3.2497
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	6.4168
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	4.9546
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	8.2044
Daily Avg. Liquid Surface Temp. (deg R):	537.0199
Daily Min. Liquid Surface Temp. (deg R):	523.3463
Daily Max. Liquid Surface Temp. (deg R):	550.6936
Daily Ambient Temp. Range (deg. R):	38.8700
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.4154
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	6.4168
Vapor Space Outage (ft):	4.1386
Working Losses (lb):	60.5046
Vapor Molecular Weight (lb/lb-mole):	67.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	6.4168
Annual Net Throughput (gal/yr.):	5 910.8000
Annual Turnovers:	11.1400
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	530.2486
Maximum Liquid Height (ft):	6.3500
Tank Diameter (ft):	3.7700
Working Loss Product Factor:	1.0000
Total Losses (lb):	378.9913

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

GP_14 - Vertical Fixed Roof Tank
Rosslyn, Gauteng

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	60.50	318.49	378.99
Hexane (-n)	0.38	2.01	2.40
Benzene	0.43	2.27	2.71
Iso-butyl alcohol	0.11	0.55	0.66
Toluene	0.50	2.65	3.15
Ethylbenzene	0.04	0.18	0.22
Xylene (-m)	0.15	0.77	0.92
Isopropyl benzene	0.01	0.03	0.04
1,2,4-Trimethylbenzene	0.01	0.07	0.08
Cyclohexane	0.06	0.31	0.37
Unidentified Components	58.82	309.63	368.45

APPENDIX

B STACK TEST REPORT

STRANDFOAM, ROSSLYN, GAUTENG

Emission and Fenceline Measurements

SKYSIDE TEST REPORT: STR003

7 NOVEMBER 2022

T0701

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PO Box 1726, Westville, Durban,3630
Skyside (Pty) Ltd 2014/276266/07
Director: Quentin Hurt

Customer:	Strandfoam 137 Frans Du Toit St Rosslyn Pretoria, 0020
Project Contact:	Phillip Laurie
Date of Testing:	6 to 20 September 2022
Date of Report:	7 November 2022
Report Reference:	STR003 Final

Report Compiled By: Quentin Hurt
Designation: Director

Report Reviewed By: Loren De Koker
Designation: Technical Manager

Report Authorised By: Quentin Hurt
Designation: Technical Signatory
Signature: Quentin Hurt

The Technical Signatory hereby declares that, to the best of his/her knowledge, the analytical data was checked for completeness, the results presented in this report are accurate and legible, and analysis was conducted in accordance with the methods in the approved protocol.

Disclaimer:

1. *The results contained in this report relate only to the streams tested and to the conditions prevalent during such tests.*
2. *In certain instances, generally identified, SKYSIDE relied on information provided by third parties. It was not possible to verify all such information independently.*
3. *The report includes the most pertinent calibration evidence and field data, but further traceability and similar data not considered immediately relevant is available at SKYSIDE offices if required. Signed calibration certificates are available on request.*
4. *This test report may not be reproduced except in full.*
5. *SKYSIDE is accredited for compliance with ISO/IEC 17025:2017.*
6. *Results marked "Not SANAS Accredited" or otherwise marked with # in this report are not included in the SANAS Scope of Accreditation for SKYSIDE.*
7. *Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.*
8. *Sample analysis is subcontracted to X-Lab Earth Science.*
9. *This report cancels and supersedes the report STR001 dated 12 February 2021 issued by SKYSIDE. The reason for the re-issue is to include a declaration of normal operating conditions and elaborate on the sampling duration in Section 6: Deviations from method and performance requirements.*

Based on SKY-QLT-REP-001 Rev. 09

DECLARATION OF NORMAL OPERATING CONDITIONS

I, Phillip Laurie, Director, hereby declare that Strandfoam, Strand, was operating at normal conditions when SKYSIDE conducted emission testing from **6 to 20 September 2022.**

Signature: ____

Executive Summary

This report covers the work performed by SKYSIDE at Strandfoam, Rossyln, Pretoria between 6 and 20 September 2022. The intention was to

- measure compounds emitted from roof vents during the extrusion process and
- characterise average fenceline concentrations of volatile organic compounds..

The site representative, Phillip Laurie, confirmed that the process was operated in a manner that can be considered representative of the typical operating conditions. No process variations, beyond standard stoppages, were observed during the tests. Testing was paused during stoppages.

The following results were determined:

Emissions monitoring:

Parameter	Front	Back	AEL Limit Value
Total VOCs [via US EPA 18]#,* *mg/dNm³*	0,07	0,10	40 000
Carbon monoxide *mg/dNm³*	<1	<1	

#not SANAS accredited

**as per laboratory's full VOC scope target list*

Toluene was the predominant component of the emission but was below 0.1 mg/dNm^3 in all samples. It is worth noting that the ratio of toluene to benzene is about 7 to 8 times.

Fenceline Monitoring (Passive Monitoring – Benzene only shown):

Location	6-13 September 2022 Benzene# ($\mu g/m^3$)	13-20 September 2022 Benzene# ($\mu g/m^3$)
North	3,0	9,7
East	3,3	8,4
South	3,3	<1,3
West	3,0	1,9

#not SANAS accredited

Samples collected on the fenceline detected mainly benzene, ethyl benzene, xylene and toluene (commonly referred to as BTEX) and trimethylbenzenes. The benzene levels in the second week would be considered elevated but it is noteworthy that foam blowing occurred during the first week only and that the ratio of toluene to benzene is closer to unity, suggesting that the source of the benzene is not the foam blowing process.

SKYSIDE considers the result to be a fair reflection of the operation of the process as tested. The testing complied with the standard test methods, except in the instances noted in the report.

Table of Contents

1 INTRODUCTION

1.1 Test Overview

Customer Details	Phillip Laurie
Site	Strandfoam, 137 Frans Du Toit St, Rosslyn, Pretoria, Gauteng
Date of Test	6 to 20 September 2022
Purpose of Test	Emission and fenceline baseline testing
Plant Process	Blown foam extrusion

1.2 Test Method Used

Method Used	Test
US EPA 18#	Volatile organic compound emissions (speciated) by thermal desorption to gas chromatograph, mass spectrometer (GS-MS)
Radiello passive sampling#	Volatile compounds present in the air by diffusive absorption followed by thermal desorption to gas chromatograph, mass spectrometer
EN 16911-1	Gas flow/temperature
EN 15058	Carbon monoxide (CO)

#not SANAS accredited

1.3 Glossary / Abbreviations

Test Parameters	
BTEX	Benzene, Toluene, Ethyl benzene, m/p-Xylene, o-Xylene
CO	Carbon monoxide
CO_2	Carbon dioxide
O_2	Oxygen
TVOC	Total volatile organic compounds
VOC	Volatile organic compounds

Measurement Units	
g	gram
kg	kilogram
µg	micrograms
h	hour
s	second
m^3	cubic meter
mg/dNm^3	milligrams per dry, normal cubic meter (expressed at standard dry conditions: temperature of 273.15 K (0 °C), absolute pressure of 101.3 kPa (1 atm), and zero moisture)
Pa	pascal
kPa	kilopascal
mm	millimeter
ppm	parts per million

SKYSIDE

Other	
ISO 17025	International Standard: General requirements for the competence of testing and calibration laboratories.
SANAS	South African National Accreditation System, established by Section 3 of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006.
Section 21 regulations	Listed activities and associated minimum emission standards identified in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).

2 THEORY OF MEASUREMENT

2.1 Velocity Measurement

Velocity and temperature were measured using a mini-vane anemometer. For calibration information, refer to Appendix C.

2.2 Volatile Organic Compounds Sampling Procedure (US EPA 18)

A gas sample of measured quantity is withdrawn from the source and collected in directly onto a prepared thermal desorption tube. The sample is withdrawn use a calibrated-flow pump operating below 200 cc/min. The sample volume was progressively increased (by increasing the sample duration) for each of the three samples This tube is then submitted to the laboratory for VOC analysis via gas chromatography.

The pump is calibrated using a low-flow BIOS Definer both before and after the test. The calibration certificate for the BIOS is available in Appendix C.

A blank sample is collected by using the tube as a sacrificial flow calibration test device at the start and end of the programme.

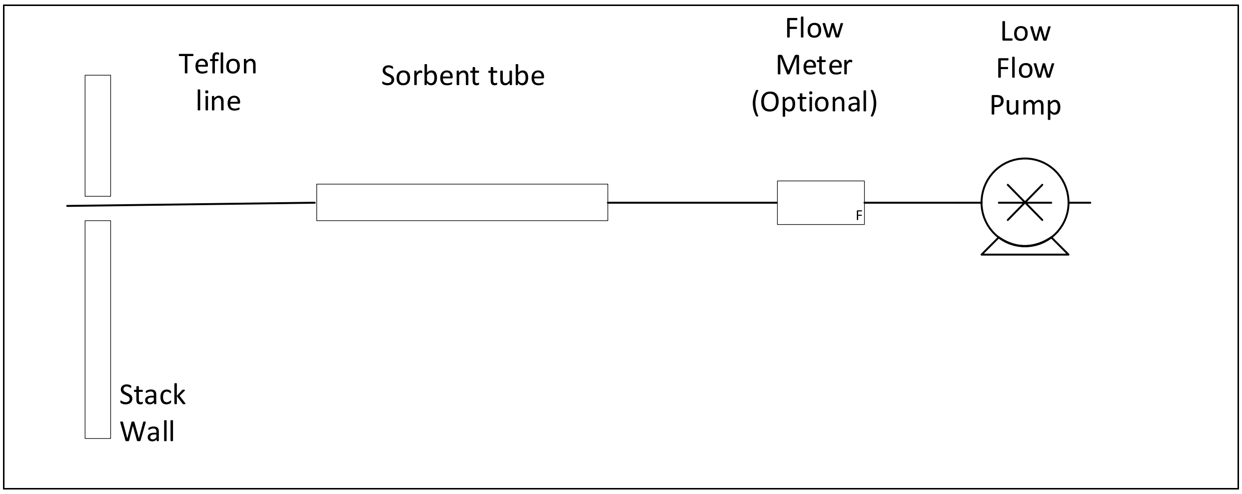


Figure 1: Gas sampling onto a thermal desorption tube (dry source)

During the tests:

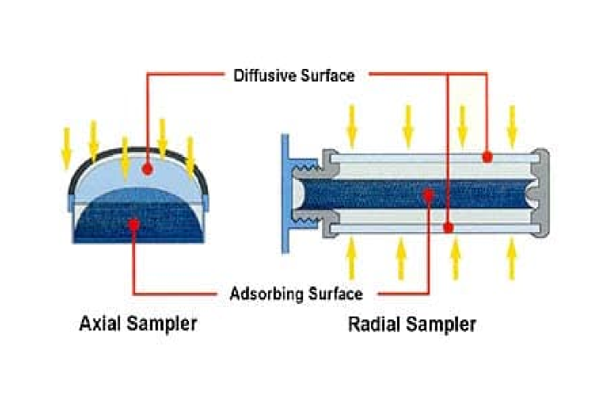
1. In order to avoid overloading the sample medium, each sample was collected intermittently over the course of the test hour.
2. Where the process was stopped (for instance to re-line the extrusion channel with paper), testing was paused.

2.3 Fenceline Ambient Radiello Passive Sampling

For the measurement of the concentrations of VOCs samples are collected using Radiello® passive samplers. Passive samplers are deployed over a period of 7 days. This method does not involve the pumping of any air, instead gases adsorb onto material contained in a collection cartridge which is located behind a diffusive barrier. This sampling method has been validated and is extensively used in Europe and has, following rigorous cross-comparison with continuous equivalent NIOSH methods, been applied by SKYSIDE in Southern African projects since 2001. The suppliers note that:

> *" . . . the performance characteristics of the Radiello sampler has been extensively characterised by the Joint Research Centre of the European Union in Ispra, Italy, one of the world's leading environmental laboratories. The device has also been employed in numerous major international field studies for benzene and ozone precursors. For the sampling and analysis of volatile organic compounds in the workplace, it is included as part of the ISO 16200-2 standard."*

Concentration ($\mu g/m^3$) = sample mass (μg) / sample volume (m^3)



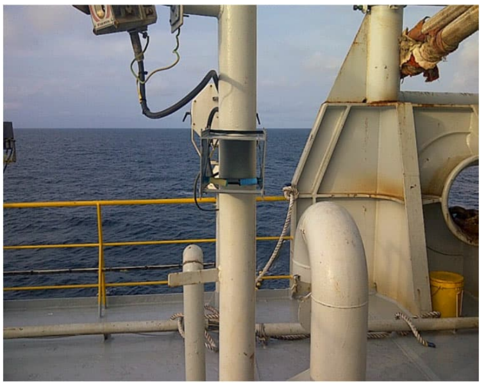


Figure 2: Radiello Passive Sampler. Image on the left shows the principle of operational of the passive diffusive sampler. Image on the right shows the typical deployment in a shelter (sampler evident in the blue casing).

3 SAMPLING PREPARATION

3.1 Sampling Location for Emissions Testing

Figure 3: Two sources above the Extrusion Line. The source on the left is referred to as Front, as it is closest to the raw material feed section. The source on the right is referred to as the Back because it is closest to the finished foam section of the line. The sample points were in approximately the same location on each source and is highlighted with a red circle on the Extrusion source. Shown is the pump analyser setup. Pictures taken towards the East and West, respectively.

3.2 Sampling Location for Fenceline Testing

Figure 4: Location of the samplers located just inside the fenceline (North, East, South and West). The location of the Extrusion Line vents is shown approximately with a red cross.

Figure 5: Location of passive sampler located on the Northern Fence (closest to the Administration offices). Location of sampling shelter indicated with orange arrow.

Figure 6: Location of passive samplers from top: Eastern fenceline (near Extrusion line), Southern fenceline (next to Training Center) and Western Boundary.

3.3 Compliance with EN 13284-1: Sampling Strategy requirements

Table 1: Sampling site method validation check

Stack	Feed	Extrusion
Sampling points conform to EN 13284-1	No	No
Working platform conforms to EN 13284-1	Yes	Yes

Table 2: Sampling gas flow properties method validation check

Stack	Feed	Extrusion
Is the angle of gas flow less than 15° with regard to duct axis?	Yes	Yes
Is there positive gas flow?	Yes	Yes
Is the differential pressure (Pitot tube) larger than 5Pa?	Yes	Yes
Is the ratio of the highest to lowest local gas velocities less than 3:1?	Yes	Yes

The customer confirmed the process was operated normally and representatively.

4 METHOD

4.1 Gases (O_2, CO, CO_2)

Table 3: Characteristics of sampling equipment

Probe	Material	Stainless Steel	Length (mm)	400
Instrument	Testo 350			
Sample Line	Teflon			
Gas Conditioning	Peltier cooler (bypassed)			
Vacuum Pump	Built into Testo instrument			
O_2 Measurement	Electrochemical cell			
CO_2 Measurement	Non-dispersive infrared (NDIR)			
CO Measurement	Electrochemical cell			
TVOC Measurement	Non-dispersive infrared (NDIR)			

Table 4: Sampling procedure and equipment validation check

Stack	FRONT	BACK
Above configuration conforms to EN 14789 and EN 15058: Description of Measuring Equipment, ISO 12039: Sampling, & US EPA 25B: Equipment and Supplies	Yes	Yes
Sampling method in accordance with EN 14789 and EN 15058: Field Operation, ISO 12039: Test procedures, & US EPA 25B: Sample Collection, Preservation, Storage, and Transport	Yes	Yes

4.2 Speciated Volatile Organic Compounds

Table 5: Characteristics of sampling equipment

Filter	Material	Sorbent tube	Diameter (mm)	3
Sample Line	Teflon			
Gas Conditioning	Direct			
Sorbent Trap	**Tenax TA 60/80**			
Vacuum Pump	GilAir Plus Low Flow Pump			
Calibration	BIOS Definer 220			
Hydrocarbon Measurement	Gas Chromatography using Mass Spectrometer (laboratory)			

Table 6: Sampling procedure and equipment validation check

Stack	Feed	Extruder
Above configuration conforms to US EPA Method 18: Equipment and Supplies	Yes	Yes
Sampling method in accordance with US EPA Method 18: Sample Collection, Preservation, Storage, and Transport	Yes	Yes

5 TEST RESULTS

5.1 Front Extrusion Source

5.1.1 Flow, CO

Table 7: Raw and average results for Feed Stack

Stack	FRONT			
Source Code	Extrusion Line			
Date	7 September 2022			
Responsible Technician	Quentin Hurt			
Run Number	1	2	3	AVG
Stack diameter (mm)	720			-
Retrieval of diameter information	Measured			-
Start time	08:25	09:25	10:25	-
End time	09:25	10:25	11:56	-
Gas velocity (m/s)	8,2	5,8	7,5	7,2
Gas flow (m^3/h)	12011	8533	10942	10495
Expressed as standard dry gas (dNm^3/h)	9545	6781	8695	8340
Gas temperature (°C)	20,7	22,8	25,5	23
Barometric pressure (kPa)	87,3	87,3	87,3	87,3
Moisture content (%)	0,8	0,8	0,8	0,8
Sample volume (L)	1,512	1,512	1,512	1,512
O_2 (vol%)[1]	20,9	20,9	20,9	20,9
CO_2 (vol%)[1]	0,4	0,4	0,4	0,4
CO (ppm)	<1	<1	<1	**<1**
Expressed as standard dry gas (mg/dNm^3)	<1	<1	<1	**<1**
Expanded uncertainty at 95% CI (mg/dNm^3)	± 4	± 4	± 4	**± 4**
CO emission (g/h)	<13	<9	<12	**<11**

[1]*reported on a dry basis*

5.1.2 Total Volatile Organic Compounds

Table 8: Summary of Results for Feed Stack

Stack	FRONT			
Source Code	Extrusion Line			
Date	7 September 2022			
Responsible Technician	Quentin Hurt			
Run Number	1	2	3	AVG
Total Speciated VOC emission (mg/dNm³)	0,05	0,09	0,07	0.07
AEL Limit Value (mg/dNm³)	**40 000**			
Speciated analysis# (µg/dNm³)				
1,2,4-trimethylbenzene	0,6	0,6	4,1	1,8
Benzene	5,5	6,0	8,0	6,5
Trichloromethane (Chloroform)	11,7	1,7	15,2	9,5
Ethylbenzene	1,6	4,0	8,5	4,7
m/p-xylene	3,7	9,2	6,7	6,5
o-xylene	1,5	3,4	3,3	2,7
Toluene	25,4	64,1	21,6	37,0

#not SANAS accredited

Results in Blue represent non-detected compounds at the test detection limit. For a full list of other compounds not detected, please refer to Appendix 3 Laboratory Results.

Table 9: Uncertainty Values for Feed Stack

Measurement uncertainty at 95% confidence level (k = 2)	
Gas content (%)	4 % or 4 mg/dNm³, whichever is greater
Speciated VOCs (%)	20
Circumstances influencing the uncertainty of results	
None.	

5.2 Back Extrusion Source

5.2.1 Flow, CO

Table 10: Raw and average results for Extrusion Line Back Stack

Stack	BACK			
Source Code	Extrusion Line			
Date	7 September 2022			
Responsible Technician	Quentin Hurt			
Run Number	**1**	**2**	**3**	**AVG**
Stack diameter (mm)	720			-
Retrieval of diameter information	Measured			-
Start time	08:25	09:25	10:25	-
End time	09:25	10:25	11:56	-
Gas velocity (m/s)	8,6	8,6	6,7	8,0
Gas flow (m^3/h)	12592	12672	9802	11689
Expressed as standard dry gas (dNm^3/h)	10007	10070	7789	9288
Gas temperature (°C)	21	23	25	23
Barometric pressure (kPa)	87,3	87,3	87,3	87,3
Moisture content (%)	0,7	0,7	0,7	0,7
Sample volume (L)	0,76	0,76	0,76	0,76
O_2 (vol%)[1]	20,9	20,9	20,9	20,9
CO_2 (vol%)[1]	0,4	0,4	0,4	0,4
CO (ppm)	<1	<1	<1	<1
Expressed as standard dry gas (mg/dNm^3)	<1	<1	<1	<1
Expanded uncertainty at 95% CI (mg/dNm^3)	± 4	± 4	± 4	**± 4**
CO emission (g/h)	<14	<14	<11	**<13**

[1]*reported on a dry basis*

5.2.2 Total Volatile Organic Compounds

Table 11: Summary of Results for Extrusion Stack

Stack	BACK			
Source Code	**Extrusion Line**			
Date	**7 September 2022**			
Responsible Technician	**Quentin Hurt**			
Run Number	**1**	**2**	**3**	**AVG**
Start time	08:25	09:25	10:25	-
End time	09:25	10:25	11:56	-
Total Speciated VOC emission (mg/dNm^3)	0,17	0,02	0,11	0,10
AEL Limit Value (mg/dNm^3)	**40 000**			
Speciated analysis# (µg/dNm^3)				
1,2,4-trimethylbenzene	1,0	1,0	7,9	3,3
Benzene	9,7	1,3	14,4	8,5
Trichloromethane (Chloroform)	2,6	2,6	8,5	4,6
Ethylbenzene	4,5	1,0	6,8	4,1
m/p-xylene	9,4	1,0	21,0	10,5
o-xylene	3,7	1,0	9,3	4,7
Toluene	134,4	9,2	46,5	63,4

#not SANAS accredited

Results in Blue represent non-detected compounds at the test detection limit. For a full list of other compounds not detected, please refer to Appendix 3 Laboratory Results.

Table 12: Validation of Results and Uncertainty Values for Extrusion Stack

Measurement uncertainty at 95% confidence level (k = 2)	
Gas content (%)	4 % or 4 mg/dNm^3, whichever is greater
Speciated VOCs (%)	20
Circumstances influencing the uncertainty of results	
None.	

5.3 Fenceline Ambient Organic Concentrations

Table 13: Average ambient concentrations of measured VOC# on Strandfoam Fenceline between 6 and 20 September 2022

	Location	North	West	East	South
	Compounds	µg/m³	µg/m³	µg/m³	µg/m³
6-13 September	Benzene	3,0	3,0	3,3	3,3
	Ethylbenzene	3,1	1,7	2,2	3,8
	m/p-xylene	5,7	4,2	5,4	8,1
	o-xylene	2,9	1,8	2,1	3,4
	Toluene	9,2	6,6	9,0	8,5
	1,2,4-trimethylbenzene	<1,6	4,4	6,7	<1,6
13-20 September	Benzene	9,7	1,9	8,4	<1,3
	Ethylbenzene	2,6	1,2	2,4	2,6
	m/p-xylene	9,0	4,3	8,7	6,9
	o-xylene	3,0	1,3	3,3	2,7
	Toluene	7,7	7,5	7,7	5,7
	1,2,4-trimethylbenzene	2,3	<1,5	2,0	2,0
	1,3,5-trimethylbenzene	2,1	<1,1	2,3	<1,1
AVERAGE	Benzene	6,3	2,5	5,8	3,3
	Ethylbenzene	2,8	1,4	2,3	3,2
	m/p-xylene	7,3	4,2	7,0	7,5
	o-xylene	3,0	1,6	2,7	3,0
	Toluene	8,4	7,1	8,4	7,1
	1,2,4-trimethylbenzene	2,3	4,4	4,4	2,0
	1,3,5-trimethylbenzene	2,1	<1,1	2,3	<1,1

#tests not SANAS accredited

6 DEVIATIONS FROM METHOD AND PERFORMANCE REQUIREMENTS

6.1 Systematic Method Deviations

1. The vents draw gas from above the extrusion line and do not encapsulate the source. The emission is therefore substantially diluted with ambient air.
2. The sample point was not optimally located for flow measurement. Flow measurements were repeated at intervals across the duct as there was a distinct distribution and even this distribution appeared to vary with external wind conditions. The flow was proportioned according to the area that each point across the diameter represented.

6.2 Plant-Related Deviations

None.

6.3 Process-Related Deviations

None.

6.4 Non-Fulfilled Performance Requirements

None.

6.5 Deviations from Proposed Measurement Programme

None.

7 DISCUSSION OF RESULTS

7.1 Emissions

7.1.1 Carbon monoxide

No carbon monoxide was detected during the test measurements. As there is no combustion source associated with the process, this result is not unexpected. During the Strandfoam Strand testing (Skyside STR001 February 2021), up to 1 ppm (part per million of gas by volume) CO only was detected during the measurements, a similar result.

7.1.2 Volatile organic compounds

Total concentrations of the speciated volatile organic compounds are substantially below the emission limit for total VOC.

Toluene was the predominant compound detected. In contrast to the results measured at Strandfoam Strand where benzene and toluene concentrations in the vents were similar, the ratio of toluene to benzene was between 7 and 8 to 1 for the Rosslyn samples. Total concentrations were similar but the Front and Back stacks exhibited similar concentrations and profiles for the Rosslyn site (with the highest emissions observed in the Back vent for Strand). It is possible that this associated with the windy conditions during sampling leading to mixing of the gas above the extrusion line.

7.2 Fenceline ambient concentrations

The fenceline samples were exposed for a week each over two consecutive weeks. The first week coincided with foam blowing.

The first week's samples showed broadly consistent values for all samples. The second week showed higher concentrations for the North and the East fencelines. Of particular note were the benzene concentrations. For the North and East Fences these reported 9,7 and 8,4 µg/m^3 during Week 2. These results are over the value set for the annual rolling average guideline of 5 µg/m^3. In itself, this result does not indicate that the benzene limit would be exceeded.

The ratio of toluene to benzene in the fenceline samples was close to 1 (as opposed to 7/8:1 in the Strandfoam source). This suggests that the source of ambient benzene is unlikely to be the foam-blowing process. Benzene is also not a raw material used by Strandfoam.

8 APPENDICES

A. Field Data

SKYSIDE

SHEQ MANAGEMENT SYSTEM

RADIELLO PASSIVE SAMPLING SHEET

Doc. Number:	AQS-QLT-FOR-034
Revision:	00
Date Issued:	02-Sep-21
Effective From:	03-Sep-21

Date: 6

Month: SEPTEMBER 22

Operator 1: QUENTIN HUNT

Project Name: STRAND FOAM ROSSLYN

Project Code: STR002

Sampling Location	BTEX Sample ID +FULL VOC	$NO_2/SO_2/HF$ Sample ID	H_2S Sample ID	Start Date	Start Time	Finish Date	Finish Time	Comments
NORTH	✓	/	/	6/9/22	15:40	13/9/22	12:12	25°37'51"S 28°05'25"E
EAST	✓			6/9/22	15:50	13/9/22	12:23	" " 56"S " 25"E
SOUTH	✓			6/9/22	16:00	13/9/22	11:42	" 38'01"S " 20'E
WEST	✓			6/9/22	16:10	13/9/22	11:59	" 37'55"S " 19"E
!								

Acknowledgement of Reporter(Name)	Q.H.(11)	Signature	Date

Comments: (*Any description or even that can affect the quality of results*)

code	sampling of	contains
RAD1231	BTEX and VOCs	white diffusive body and cartridge code RAD130
RAD1232	BTEX and VOCs	yellow diffusive body and cartridge code RAD145
RAD1233	NO_2, SO_2 and HF	blue diffusive body and cartridge code RAD166
RAD1233	Aldehydes	blue diffusive body and cartridge code RAD165
RAD1235	ozone	blue diffusive body and cartridge code RAD172
RAD1236	hydrogen sulfide	white diffusive body and cartridge code RAD170
RAD1237	ammonia	blue diffusive body and cartridge code RAD168
RAD1238	HCl	white diffusive body and cartridge code RAD169

SKYSIDE	**SHEQ MANAGEMENT SYSTEM** **NIOSH Sampling Record**	Doc. Number:	SKY-QLT-FOR-008
		Revision:	00
		Date Issued:	12-May-17
		Effective From:	19-May-17

Site	**Strandfoam Rosslyn**	Date	**07-Sep-22**
Project code	**STR002**	Source name	**Extruder FRONT**

Sampling method	**EPA 17**	Thomas pump ID	**NA**
Pre-sampling purge duration	**0**	Gilian pump ID	**21211721**

Run 1	Sampling time	Start time: 8:25	End time: 9:25
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	19	
	Pre cal flow	252	
	Post cal flow	251	
	Stack temperature (°C)	21	
	Stack pressure (hPa)	873	
	Transfer Time	Start time: NA	End time: NA

Run 2	Sampling time	Start time: 9:25	End time: 10:25
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	21	
	Pre cal flow	251	
	Post cal flow	252	
	Stack temperature (°C)	23	
	Stack pressure (hPa)	873	
	Transfer time	Start time: NA	End time: NA

Run 3	Sampling time	Start time: 10:25	End time: 11:30
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	23	
	Pre cal flow	252	
	Post cal flow	252	
	Stack temperature (°C)	25	
	Stack pressure (hPa)	873	
	Transfer time	Start time: NA	End time: NA

Field Sample List

Run 1: test tube label	1125547
Run 2: test tube label	1125221
Run 3: test tube label	1125394
Sample blank: test tube label	1126594

Notes:
Extrusion paused between 10:35 and 11:06. Sampling was paused during this time.

Technician Quentin Hurt

Manager

Signed Quentin Hurt

Signed

SKYSIDE	**SHEQ MANAGEMENT SYSTEM** **NIOSH Sampling Record**	Doc. Number:	SKY-QLT-FOR-008
		Revision:	00
		Date Issued:	12-May-17
		Effective From:	19-May-17

Site	**Strandfoam Rosslyn**	Date	**07-Sep-22**
Project code	**STR002**	Source name	**Extruder BACK**

Sampling method	**EPA 17**	Thomas pump ID	**NA**
Pre-sampling purge duration	**0**	Gilian pump ID	**0211718**

Run 1	Sampling time	Start time: 8:25	End time: 9:25
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	19	
	Pre cal flow	160	
	Post cal flow	160	
	Stack temperature (°C)	20,7	
	Stack pressure (hPa)	873	
	Transfer Time	Start time: NA	End time: NA

Run 2	Sampling time	Start time: 9:25	End time: 10:25
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	21	
	Pre cal flow	161	
	Post cal flow	160	
	Stack temperature (°C)	22,8	
	Stack pressure (hPa)	873	
	Transfer time	Start time: NA	End time: NA

Run 3	Sampling time	Start time: 10:25	End time: 11:30
	Ambient pressure (hPa)	873	
	Ambient temperature (°C)	23	
	Pre cal flow	160	
	Post cal flow	160	
	Stack temperature (°C)	25,5	
	Stack pressure (hPa)	873	
	Transfer time	Start time: NA	End time: NA

Field Sample List

Run 1: test tube label	1125175
Run 2: test tube label	1125982
Run 3: test tube label	1124144
Sample blank: test tube label	1126594

Notes:
Extrusion paused between 10:35 and 11:06. Sampling was paused during this time.

Technician Quentin Hurt

Manager

Signed Quentin Hurt

Signed

Flow measurement

	FRONT		BACK	
Stack diameter	0,72	m	0,72	m
Stack area	0,41	m2	0,41	m2

Point across duct	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
cm	m/s	m/s	m/s	m/s	m/s	m/s
5	10	7,8	11,7	12,5	10	6,5
10	8	4,8	11,4	13,2	7,6	3,7
15	7,1	8,4	10,6	10,3	8,9	6,4
20	4	7,4	8,8	8	6,9	1,5
25	4,5	3	5,4	6,4	1	1,2
30	1,4	2,4	3,8	2,8	1,7	3,5
35	0,7	3,4	1	3,7	2,5	3,5
40	0,9	4,4	1,9	2,1	2,2	5,5
45	3	3,6	3,3	2,5	4	8
50	5,4	3,9	4	5	6,5	9,1
55	7,8	4,8	5,2	6,8	6,1	10,6
60	9,1	5,8	4,8	7,2	10	10,6
65	10,6	5	4	6	11,6	8,5

Flow measurement

Flow-adjusted measurements

Point across duct cm	FRONT Run 1	Run 2	Run 3	Average	BACK Run 1	Run 2	Run 3	Average
5	2,046	1,596	2,394		2,558	2,046	1,330	
10	0,880	0,528	1,254		1,452	0,836	0,407	
15	0,631	0,746	0,942		0,915	0,791	0,569	
20	0,271	0,501	0,596		0,541	0,467	0,102	
25	0,209	0,140	0,251		0,298	0,047	0,056	
30	0,043	0,073	0,116		0,086	0,052	0,107	
35	0,004	0,018	0,005		0,019	0,013	0,018	
40	0,001	0,007	0,003		0,003	0,003	0,009	
45	0,049	0,058	0,053		0,040	0,065	0,129	
50	0,206	0,148	0,152		0,190	0,247	0,346	
55	0,462	0,284	0,308		0,403	0,361	0,628	
60	0,731	0,466	0,386		0,579	0,804	0,852	
65	2,662	1,256	1,005		1,507	2,913	2,135	
Average (m/s)	8,2	5,8	7,5	7,2	8,6	8,6	6,7	8,0
Volumetric (m3/s)	3,3	2,4	3,0	2,9	3,5	3,5	2,7	3,2
Volumetric (m3/h)	12011	8533	10942	10495	12592	12672	9802	11689
0	87,3	87,3	87,3	87,3	87,3	87,3	87,3	87,3
Temperature (°C)	20,7	22,8	25,5	23	21	23,2	25	23
Relative humidity (%)	0,8	0,8	0,8	1	0,7	0,7	0,7	1
Volumetric flow (STP)	12851	9065	11519	11145	13473	13457	10347	12426

B. Calibration Sheets

Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

ANSI National Accreditation Board (ANAB) ... ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY L2347.01

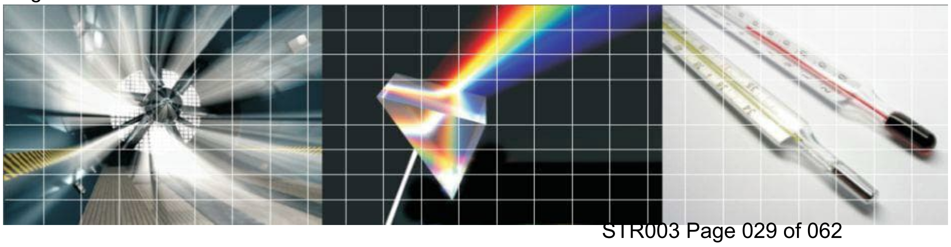
ANSI National Accreditation Board (ANAB) is a member of the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA). This arrangement allows for the mutual recognition of technical test and calibration data by the member accreditation bodies worldwide. For more information on the arrangement please consult www.ilac.org. The accuracies of all measurements were traceable to the SI (International System of Units) through NIST, NMISA, PTB or International Measuring Standards, unless otherwise noted. The uncertainties of measurement were estimated for a coverage factor of k=2 which approximates to a 95% confidence level.

American Standard Calibration Laboratory
Measurement Science Laboratory

GOLDILUX

Certificate No	L85077	As Found/As Left	Rev 0
Manufacturer	Bios International Corp		
Description	Primary Air Flow Calibrator - Low Flow		
Model No	Defender 510-L		
Serial No	112452		
Plant No	EE225		
Calibrated for	Skyside South Africa (Pty) Ltd		
Address	2 Samantha Street, Strydompark, Randburg, 2169		
Temperature	(21.7 ± 2) °C		
Relative humidity	(30 ± 5) %rh		
Date of calibration	08 July 2022		
Expiry date	08 July 2023	Issue Date	08 July 2022
Calibrated by			

Technical Signatory



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Fax +27 (0) 12 345 3263

Technology Solutions
Measurement Science Laboratory

Certificate of Calibration

Certificate No L85077 As Found/As Left Rev 0

Standards and Equipment used

Description	Asset No	Cal due
Electronic Base; Dry Flow Cells	TS283	14 October 2023
Thermo-Hygrometer	TS294	09 May 2023
Bios DryCal	TS278	Source Only

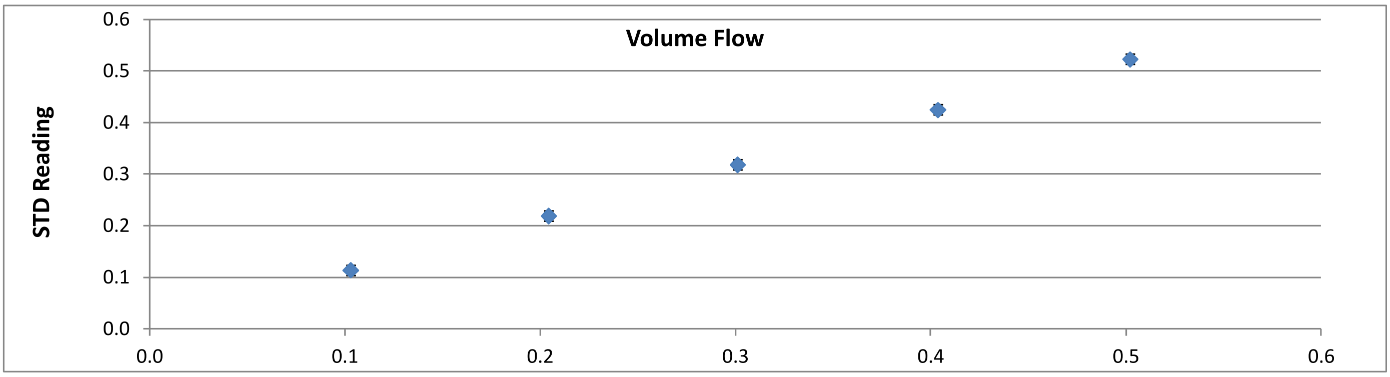
Procedure TS PL 024

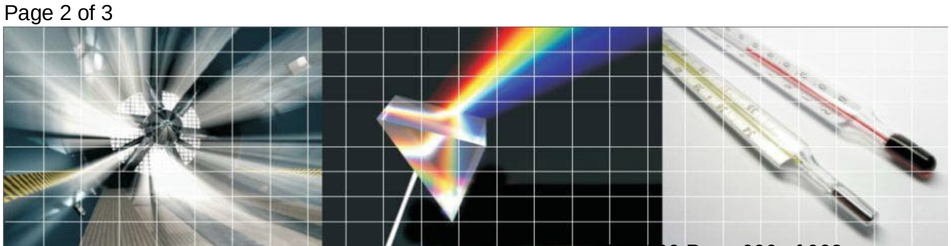
Results

Measurement Units LPM Range 0.5 LPM

Nominal Flow	STD Reading	STD Temperature (°C)	STD Pressure (psi)	UUT Reading	UUT Temperature (°C)	UUT Pressure (psi)	UUT Correction factor	Specification	Measurement Uncertainty (±)
0.10	0.103	21.3	12.50	0.113			0.91	0.01	0.01
0.20	0.204	21.3	12.50	0.218			0.94	0.01	0.01
0.30	0.301	21.3	12.50	0.318			0.95	0.01	0.01
0.40	0.404	21.4	12.50	0.424			0.95	0.01	0.01
0.50	0.502	21.3	12.50	0.522			0.96	0.01	0.01

Status	**Instrument Received in Good Physical and Functional Condition.**
Comments	**The correction must be multiplied with the UUT reading to obtain the corrected value.** **The readings presented above are averaged data.** **LPM conditions are stated for prevailing gas temperature and pressure. (Volume Flow)**





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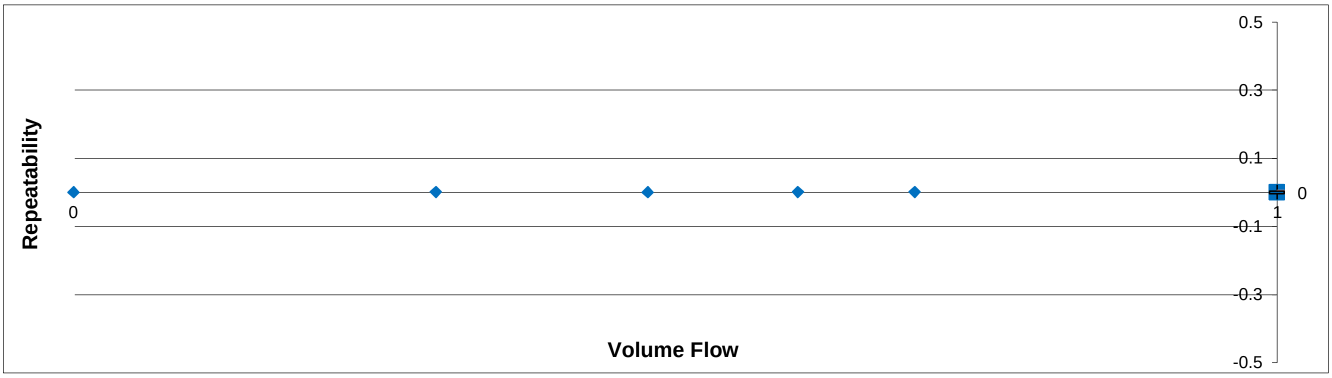
Measurement Science Laboratory

Certificate of Calibration

Certificate No L85077 As Found/As Left Rev 0

Repeatability Repeatability is defined as the closeness of the agreement between the results of successive measurements of the same measurand carried out under the same measurement conditions.

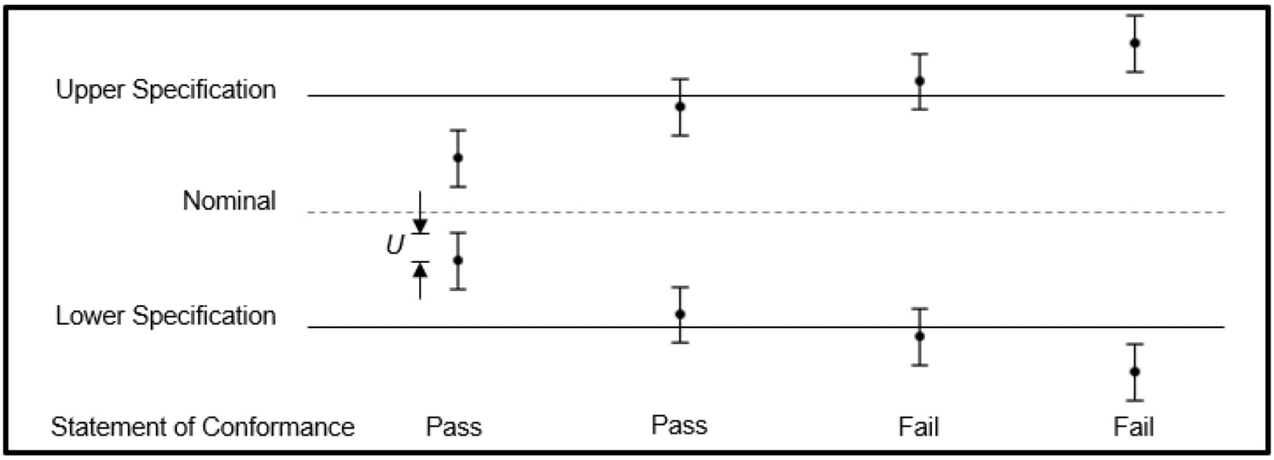


Compliance with Specifications - ILAC-G8

The laboratory implements the shared risk approach as defined in ILAC-G8:09/2019, Section 4.2.1 - Binary Statement for Simple Acceptance Rule (w = 0) when making statements of conformity.

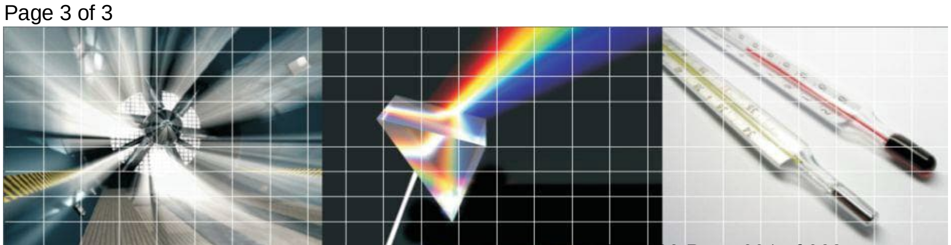
Statements of conformity are reported as:

Pass - the measured value is within the specification.
Fail - the measured value is outside the specification.



U = 95% expanded measurement uncertainty

End of Calibration Data



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GAS CALIBRATIONS		SKY-QLT-FOR-014	REV
Gas analyser	Testo 350	Asset/serial number	EE194
Zero gas serial number		Clean filter?	Yes
		Data file number	

Checks	NO	NO_2	SO_2	CO	CO_2	O_2
Gas analyser measurement concentration range (ppm/%)	0-4000	0-500	0-5000	0-10000	0-50	0-25
Gas standard serial number				M55 5707	M55 5707	M55 5707
Gas standard concentration (ppm/%)				100,2	15,01	5,136
Zero pre-sampling response				0	0	0,03
Span response pre-calibration				96		5,2
Span response post-calibration						
Pre-sampling deviation from standard *(Limit <2%)*				4,2%		-0,7%
Span response time (sec)						
Zero post sampling response				0		0
Span response post sampling				97		5,19
Post-test drift at span point (%) *(Limit <15% after 3-hr test)*				1,0%		0,4%
Post-test drift at zero (%)				0,0%		-0,6%

	Check during calibration	On-site pre-test check
Operating temperature		
Gas analyser maximum ambient operation temperature ($^{\circ}$C)	45	45
Analyser case temperature ($^{\circ}$C)	23,2	
Sample flow		
Leak test on conditioning system (pass/fail)	Pass	
Gas analyser flow rate (l/min)	0,43	
Method		
Sampling train complies with method?		
Sampling procedure complies with method?		

Please describe deviations in Comments section below

Comments

RESPONSIBLE PERSON

Form completed by	Thabang	Date	25/10/2022
Form reviewed by	Quentin Hurt	Date	25/10/2022

nmisa
National Metrology Institute of South Africa

Certificate of Analysis

Private Bag X34, Lynnwood Ridge, Pretoria, 0040
CSIR Campus, Meiring Naude Road, Brummeria, 0184
Calibration office: +27 12 841 4623
Reception: +27 12 841 4152
Fax: +27 12 841 4458
E-mail enquiries: info@nmisa.org

Facility Accreditation Number: **RMP002**
Name and Customer Address: SKYSIDE (PTY) LTD
Ninian Westmead Estate
Unit 2, Building 4
33 Henry Pennington Rd
Pinetown
Durban
South Africa Strijdom Park Gauteng South Africa

Description: Primary Reference Gas Mixture (PRGM), cylinder number M55 5707 containing a mixture of carbon dioxide (CO_2), carbon monoxide (CO) and oxygen (O_2) in nitrogen (N_2) prepared on 06 July 2022.

Method of Preparation: Gravimetric preparation in accordance with the International Organization for Standardization, ISO 6142 (Gas Analysis – Preparation of calibration gas mixtures – Gravimetric Method). After preparation, the composition was verified using non-dispersive infrared spectroscopy for CO and CO_2, and gas chromatography coupled with thermal conductivity detection for O_2.

Intended use: The material can be used to validate and/or calibrate analytical methods or for the calibration of measurement systems used to determine the amount fraction of CO_2, CO and O_2 in N_2.

Result: The amount fraction of CO_2: (15,01 ± 0,15) % mol/mol
The amount fraction of CO: (100,2 ± 1,0) µmol/mol
The amount fraction of O_2: (5,136 ± 0,052) % mol/mol

Uncertainty: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by a coverage factor, $k = 2$, which for a normal distribution approximates a level of confidence of 95,45 %.

Traceability: The amount fraction is traceable to the national standard of mass and, by comparison, to NMISA primary standard gas mixtures (PSGMs).

Homogeneity: The homogeneity of the mixture has been assured by rolling the cylinder on a roller bench for a minimum of 2 hours after preparation.

Analysed by **Prelly Marebane** Metrologist	Checked by **Mphara Mogale** Metrologist	For Chief Executive Officer
Date of Issue 2022/08/01	Page 1 of 2	Certificate Number **NMISA-GAS-2022-2238**

TQM-5096-1

Stability: The certification of the gas mixture is valid until 06 July 2024, provided the cylinder pressure does not drop below 500 kPa.

Storage: Store away from direct heat between temperatures of 10 to 40 °C in a well-ventilated area. More guidance on the use of calibration gas mixtures can be found in ISO 16664 (Gas Analysis – Handling of calibration gases and gas mixtures – Guidelines).

Safety: The cylinder should be handled with care and by experienced personnel in a laboratory environment suitably equipped for the safe handling of gaseous materials.

Cylinder: The PRGM is contained in a passivated aluminium cylinder. The cylinder has a water capacity of 5 ℓ and is pressurised to 9,7 MPa. The outlet connection of the cylinder valve conforms to BS3 specifications.

Remarks: The reported uncertainties of measurements were calculated in accordance with the BIPM, IEC, ISO, IUPAP, OIML document entitled "Guidance to the Expression of Uncertainty in Measurement" (International Organization for Standardization, Geneva, Switzerland, 2008).

The national measurement standards are monitored for stability at intervals of 3 months, 6 months, 9 months and then annually after preparation. Customers will be notified of any stability problems and mixtures will be recertified free of charge if such problems are encountered.

Certain of the NMISA certificates are consistent with the capabilities that are included in appendix C of the MRA (Mutual Recognition Arrangement) drawn up by the CIPM. Under the MRA, all participating institutes recognise the validity of each other's calibration and measurement certificates for the quantities and ranges and measurement uncertainties specified in Appendix C. For details see http://www.bipm.org.

---*end of certificate*---

Analysed by **Prelly Marebane** Metrologist	Checked by **Mphara Mogale** Metrologist	For Chief Executive Officer
Date of Issue 2022/08/01	Page 2 of 2	Certificate Number **NMISA-GAS-2022-2238**

GravCalc Version 2.3.1

Gravimetric composition of cylinder PRGM0200555707

Date: 15/07/2022
Time: 10:58:41
Operator: PM Mixture prepared by: PM
Lab book: weighing formula

OUTPUTS
=======

Component	µmol/mol	uncertainty	% u/c
N2	798381.6402	7.75074647	0.001
CO2	150149.7865	4.62903918	0.003
O2	51362.02028	2.54101844	0.005
CO	100.2072297	0.03366202	0.034
Ar	13.67128351	0.27644958	2.022
H2	3.25783425	0.18234397	5.597
CH4	1.54178155	0.22857474	14.825
H2O	0.06342389	0.03004794	47.376
C2H6	0.01306452	0.00541077	41.416
N2O	0.00001089	0.00000627	57.547

INPUTS
======

File	Mass (g)	u/c (g)
History\NMISA010	38.16400	0.00200
O2UHP334129.txt	44.73700	0.00200
PURECO209122.txt	179.8600	0.00200
BIPN2BATCH220217	570.4230	0.00200

INPUT DATA FILES
================

°°°°°°°°° History\NMISA0100732295.txt °°°°°°°°°°

Component	mol/mol	uncertainty
N2	0.9979358981	0.0000029906
CO	0.0020000000	0.0000001223
Ar	0.0000635130	0.0000029770
H2	0.0000004990	0.0000002704

International Chemical Safety Cards

CARBON DIOXIDE

ICSC: 0021

CARBON DIOXIDE
Carbonic acid gas
Carbonic anhydride
(cylinder)
CO_2
Molecular mass: 44.0

CAS # 124-38-9
RTECS # FF6400000
ICSC # 0021
UN # 1013

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Containers may burst in the heat of a fire!		In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE			
• **INHALATION**	Dizziness. Headache. Elevated blood pressure. Tachycardia.	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
• **EYES**	On contact with liquid: frostbite.	Safety goggles, or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**			

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. NEVER direct water jet on liquid (extra personal protection: self-contained breathing apparatus).	Fireproof if in building. Cool.	UN Hazard Class: 2.2

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0021

International Chemical Safety Cards

CARBON DIOXIDE

ICSC: 0021

Safety Data Sheet

Product :	**Oxygen**	Page :1/4
MSDS Nr : 097A_AL	Version : 1.01	Date : 31/07/2002

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY

MSDS Nr	097A_AL
Product name	Oxygen
Chemical formula	O2
Company identification	see heading and/or footer see paragraph 16 "OTHER INFORMATION"
Emergency phone numbers	see heading and/or footer see paragraph 16 "OTHER INFORMATION"

2 COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Preparation	Substance.
Components/Impurities	Contains no other components or impurities which will influence the classification of the product.
CAS Nr	07782-44-7
EEC Nr (from EINECS)	231-956-9

3 HAZARDS IDENTIFICATION

Hazards identification	Compressed gas Oxidant. Strongly supports combustion. May react violently with combustible materials.

4 FIRST AID MEASURES

Inhalation	Continuous inhalation of concentrations higher than 75% may cause nausea, dizziness, respiratory difficulty and convulsion. Remove victim to uncontaminated area.

5 FIRE FIGHTING MEASURES

Specific hazards	Supports combustion. Exposure to fire may cause containers to rupture/explode. Non flammable
Hazardous combustion products	None
Suitable extinguishing media	All known extinguishants can be used.
Specific methods	If possible, stop flow of product. Move away from the container and cool with water from a protected position.

Relative density, liquid	1.1 (water=1)
Vapour Pressure 20°C	Not applicable.
Solubility mg/l water	39 mg/l
Appearance/Colour	Colourless gas
Odour	No odour warning properties.
Autoignition temperature	Not applicable
Flammability range	Oxidiser.
Other data	Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

10 STABILITY AND REACTIVITY

Stability and reactivity	May react violently with combustible materials May react violently with reducing agents. Violently oxidises organic material.

11 TOXICOLOGICAL INFORMATION

General	No toxicological effects from this product.

12 ECOLOGICAL INFORMATION

General	No ecological damage caused by this product.

13 DISPOSAL CONSIDERATIONS

General	To atmosphere in a well ventilated place. Do not discharge into any place where its accumulation could be dangerous. Contact supplier if guidance is required.

14 TRANSPORT INFORMATION

Proper shipping name	Oxygen, compressed
UN Nr	1072
Class/Div	2.2
Subsidiary risk	5.1
ADR/RID Classification code	2,1° O
ADR/RID Hazard Nr	25
Labelling ADR	Label 2: non flammable non toxic gas Label 05: fire intensifying risk.

C. Laboratory Results

From:	Quentin Hurt	**Contact No:**	082 444-9320
Company:	Skyside	**E-mail:**	qh@skyside.co.za
Date:	9/922	**PO Number:**	STR002
No. Samples:	7	**Project No:**	STR002
Mode of Transport:	By Hand		

#	Sample ID	Date of Collection	Matrix	Storage container	Analysis Required
1	1125547 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
2	1125221 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
3	1125394 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
4	1126594 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
5	1125175 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
6	1125982 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
7	1124144 ✓	7/9/22	Gas	TD Tube	VOC (Method 17)
8					
9					
10					
11					
12					
13					
14					
15					

Special Instructions:

Relinquished by	Date	Time	Received by	Date	Time
Quentin Hurt	9/9/22	10:00	Thembi Mtshali	9/9/22	10:00
Quentin Hurt					

Comments:

DATE: 09-09-22
NAME: Thembi
SIGNATURE: Mtshali

	SHEQ MANAGEMENT SYSTEM	Doc Number:	LAB-QLT-FOR-001B
X-LAB EARTH	REQUEST FOR LABORATORY SERVICES AND CHAIN OF CUSTODY FORM	Revision:	03
		Date Issued:	15 February 2021
		Effective From:	16 February 2021

THERMAL DESORPTION AND RADIELLO SAMPLES

Name:	Quentin Hurt		
Company:	Skyside Industrial.		
Contact No:	082 444 9320		
E-mail:	Quentin@skyside.co.za		
Date:	13/09/2022	**No. Samples:**	
PO Number:	STR002	**Project No:**	STR002
Condition of Samples:			

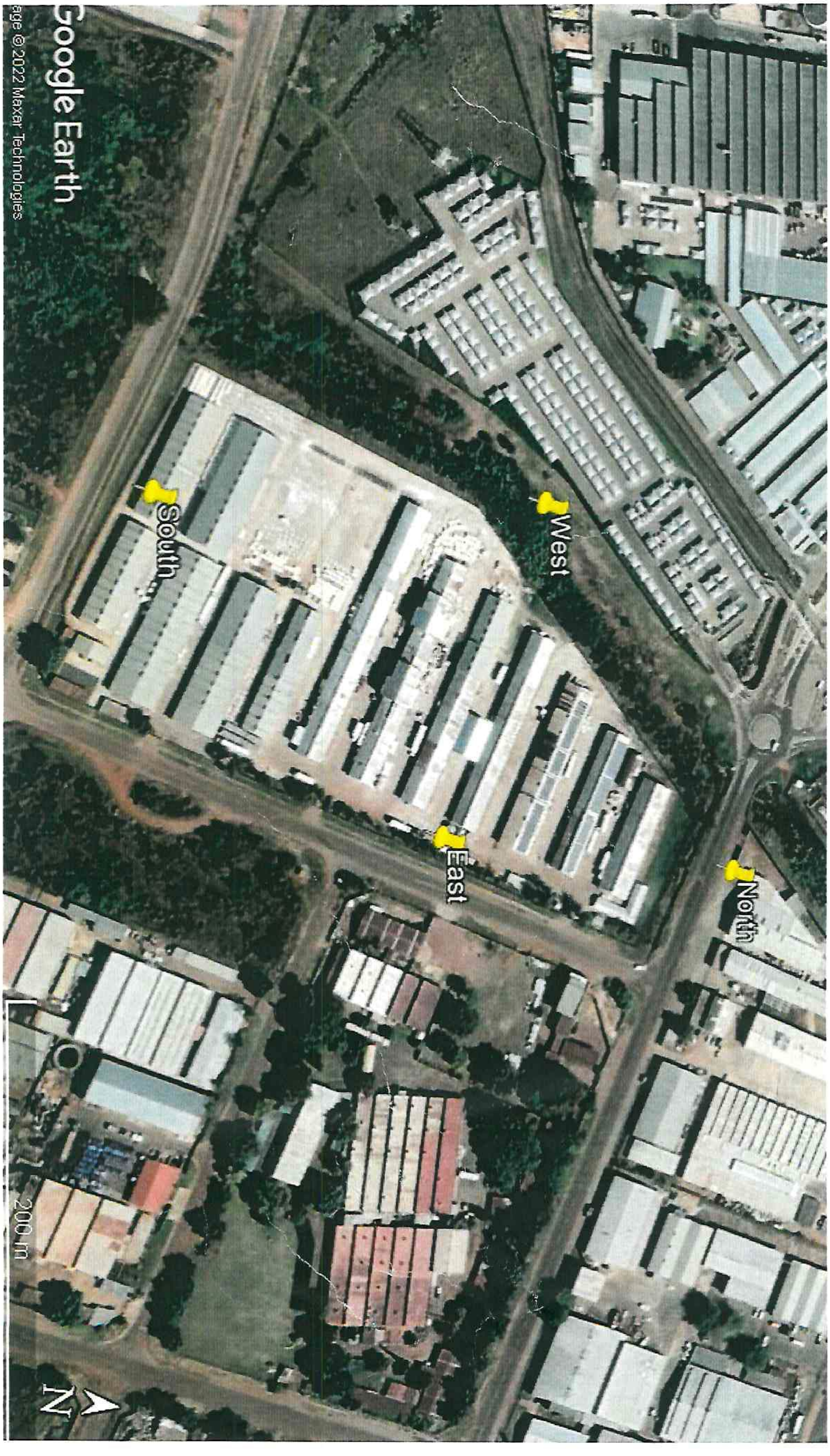
#	Sample ID	Matrix	Analysis Required				Exposure Time			
			NH_3	H_2S	BTEX + Full VOC.	NO_2/SO_2	Start Date	Start Time	End Date	End Time
1	CH595 - North	RAD 130			✓		6/9/22	15:40	13/9/22	12:12
2	CH596 - WEST	RAD 130			✓		6/9/22	16:10	13/9/22	11:59
3	CH598 - EAST	RAD 130			✓		6/9/22	15:50	13/9/22	12:23
4	CH597 - SOUTH	RAD 130			✓		6/9/22	16:00	13/9/22	11:42
5										
6										
7										
8										
9										
10										
11										
12										
13										

Comments:

Relinquished by:	Date	Time	Received by:	Date	Time
Temaswati	13/9/22	14:53			

DATE: 14-09-22
NAME: Thembi
SIGNATURE: Mtshali

9!



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age © 2022 Maxar Technologies
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X-LAB EARTH	SHEQ MANAGEMENT SYSTEM REQUEST FOR LABORATORY SERVICES AND CHAIN OF CUSTODY FORM	Doc Number:	LAB-QLT-FOR-001B
		Revision:	03
		Date Issued:	15 February 2021
		Effective From:	16 February 2021

THERMAL DESORPTION AND RADIELLO SAMPLES

Name:	Quentin Hurt		
Company:	Skyside Industrial		
Contact No:	082 444 9320		
E-mail:	Quentin@skyside.co.za		
Date:	20/09/2022	**No. Samples:**	
PO Number:	~~STR002~~ STR003	**Project No:**	STR003
Condition of Samples:			

#	Sample ID	Matrix	Analysis Required				Exposure Time			
			NH_3	H_2S	BTEX + Full VOC	NO_2/SO_2	Start Date	Start Time	End Date	End Time
1	NO969 - North ✓	RAD 130			✓		13/9/2022	12:12	20/09/2022	11:35
2	NO971 - West ✓	RAD 130			✓		13/9/2022	11:59	20/09/2022	11:44
3	NO968 - East ✓	RAD 130			✓		13/9/2022	12:23	20/09/2022	11:56
4	NO970 - South ✓	RAD 130			✓		13/9/2022	11:42	20/09/2022	11:50
5	W555E - Blank ✓	RAD 130			✓				20/09/2022	12:00
6										
7										
8										
9										
10										
11										
12										
13										

Comments:

Relinquished by:	Date	Time	Received by:	Date	Time
Thabang	20/09/2022	14:29			

DATE: 20-09-22
NAME: Thembi
Mtshali

TEST REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Quentin Hurt	Laboratory	X-Lab Earth Science
Client	SKYSIDE (PTY) LTD	Address	2 Samantha Street, Strydompark, Randburg, 2169
Address	2 Samantha Street Strydompark Randburg	Telephone	+27 (0)11 590 3000
Telephone		Laboratory Manager	Mrs Tasneem Tagari
Facsimile		Lab Reference	JBX22-12840
Email		Report Number	0000049491
		Date Received	09/09/2022 13:14
Order Number	STR003	Date Started	19/10/2022 8:51
Samples	7	Date Reported	20/10/2022 16:00
Sample matrix	AIR		

The document is issued in accordance with SANAS's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. SANAS accredited laboratory T0775.

T0775

Samples received at ambient temp good condition.
#Samples outsourced to Chemtech Laboratory as instrument is down.

SIGNATORIES

Tasneem Tagari

General Manager/Technical Signatory

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name: JBX22-12840.001 1125547	JBX22-12840.002 1125221	JBX22-12840.003 1125394	JBX22-12840.004 1126594

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061

Parameter	Units	LOR	JBX22-12840.001	JBX22-12840.002	JBX22-12840.003	JBX22-12840.004
Trichloromethane (Chloroform) *	ng/tube	2	14	<2.0	18	<2.0
1,1,1-trichloroethane *	ng/tube	0.95	<0.95	<0.95	<0.95	<0.95
1,2-dichloroethane *	ng/tube	0.65	<0.65	<0.65	<0.65	<0.65
Benzene	ng/tube	1	6.6	7.2	9.5	<1.0
1,2-dichloropropane *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
Trichloroethene *	ng/tube	0.5	<0.50	<0.50	<0.50	<0.50
Dibromomethane *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
cis-1,3-dichloropropene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
Toluene	ng/tube	1	32	78	27	10
trans-1,3-dichloropropene *	ng/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,1,2-trichloroethane *	ng/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,3-dichloropropane *	ng/tube	0.65	<0.65	<0.65	<0.65	<0.65
Tetrachloroethene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
Bromodichloromethane *	ng/tube	1	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane *	ng/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,2-dibromoethane *	ng/tube	0.95	<0.95	<0.95	<0.95	<0.95
Chlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,1,1,2-tetrachloroethene *	ng/tube	0.9	<0.90	<0.90	<0.90	<0.90
Carbon tetrachloride *	ng/tube	1	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	ng/tube	0.75	1.9	4.8	10	<0.75
m/p-xylene	ng/tube	0.8	4.5	11	7.9	<0.80
o-xylene	ng/tube	0.75	1.8	4.0	3.9	<0.75
Styrene *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
Bromoform *	ng/tube	2	<2.0	<2.0	<2.0	<2.0
Isopropylbenzene (Cumene) *	ng/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,1,2,2-tetrachloroethane *	ng/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,2,3-trichloropropane *	ng/tube	0.9	<0.90	<0.90	<0.90	<0.90

Report number 0000049491
Client reference:
STR003

TEST REPORT

Parameter	Units	Sample Number Sample Name LOR	JBX22-12840.001 1125547	JBX22-12840.002 1125221	JBX22-12840.003 1125394	JBX22-12840.004 1126594

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061 (continued)

n-propylbenzene *	ng/tube	2	<2.0	<2.0	<2.0	<2.0
Bromobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
2-chlorotoluene *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,3,5-trimethylbenzene *	ng/tube	0.55	<0.55	<0.55	<0.55	<0.55
4-chlorotoluene *	ng/tube	0.7	<0.70	<0.70	<0.70	<0.70
1,3-dichlorobenzene *	ng/tube	1	<1.0	<1.0	<1.0	<1.0
tert-butylbenzene *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trichlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
sec-butylbenzene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
p-Isopropyltoluene (p-Cymene) *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,4-dichlorobenzene *	ng/tube	0.75	<0.75	<0.75	<0.75	<0.75
n-butylbenzene *	ng/tube	2	<2.0	<2.0	<2.0	<2.0
1,2-dichlorobenzene *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2-dibromo-3-chloropropane *	ng/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trimethylbenzene *	ng/tube	0.75	2.5	<0.75	8.2	3.4
Hexachlorobutadiene *	ng/tube	0.5	<0.50	<0.50	<0.50	<0.50
Naphthalene *	ng/tube	0.5	<0.50	<0.50	<0.50	<0.50
1,2,3-trichlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80	<0.80

X-LAB EARTH

Report number 0000049491
Client reference:
STR003

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name: JBX22-12840.005 1125175	JBX22-12840.006 1125982	JBX22-12840.007 1124144

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061

Trichloromethane (Chloroform) *	ng/tube	2	<2.0	<2.0	6.5
1,1,1-trichloroethane *	ng/tube	0.95	<0.95	<0.95	<0.95
1,2-dichloroethane *	ng/tube	0.65	<0.65	<0.65	<0.65
Benzene	ng/tube	1	7.4	<1.0	11
1,2-dichloropropane *	ng/tube	0.85	<0.85	<0.85	<0.85
Trichloroethene *	ng/tube	0.5	<0.50	<0.50	<0.50
Dibromomethane *	ng/tube	0.8	<0.80	<0.80	<0.80
cis-1,3-dichloropropene *	ng/tube	0.8	<0.80	<0.80	<0.80
Toluene	ng/tube	1	104	8.5	36
trans-1,3-dichloropropene *	ng/tube	0.9	<0.90	<0.90	<0.90
1,1,2-trichloroethane *	ng/tube	0.9	<0.90	<0.90	<0.90
1,3-dichloropropane *	ng/tube	0.65	<0.65	<0.65	<0.65
Tetrachloroethene *	ng/tube	0.8	<0.80	<0.80	<0.80
Bromodichloromethane *	ng/tube	1	<1.0	<1.0	<1.0
Dibromochloromethane *	ng/tube	0.75	<0.75	<0.75	<0.75
1,2-dibromoethane *	ng/tube	0.95	<0.95	<0.95	<0.95
Chlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80
1,1,1,2-tetrachloroethene *	ng/tube	0.9	<0.90	<0.90	<0.90
Carbon tetrachloride *	ng/tube	1	<1.0	<1.0	<1.0
Ethylbenzene	ng/tube	0.75	3.4	<0.75	5.2
m/p-xylene	ng/tube	0.8	7.2	<0.80	16
o-xylene	ng/tube	0.75	2.8	<0.75	7.1
Styrene *	ng/tube	0.85	<0.85	<0.85	<0.85
Bromoform *	ng/tube	2	<2.0	<2.0	<2.0
Isopropylbenzene (Cumene) *	ng/tube	0.75	<0.75	<0.75	<0.75
1,1,2,2-tetrachloroethane *	ng/tube	0.9	<0.90	<0.90	<0.90
1,2,3-trichloropropane *	ng/tube	0.9	<0.90	<0.90	<0.90

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name: JBX22-12840.005 / 1125175	JBX22-12840.006 / 1125982	JBX22-12840.007 / 1124144

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061 (continued)

Parameter	Units	LOR	JBX22-12840.005	JBX22-12840.006	JBX22-12840.007
n-propylbenzene *	ng/tube	2	<2.0	<2.0	<2.0
Bromobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80
2-chlorotoluene *	ng/tube	0.85	<0.85	<0.85	<0.85
1,3,5-trimethylbenzene *	ng/tube	0.55	<0.55	<0.55	<0.55
4-chlorotoluene *	ng/tube	0.7	<0.70	<0.70	<0.70
1,3-dichlorobenzene *	ng/tube	1	<1.0	<1.0	<1.0
tert-butylbenzene *	ng/tube	0.85	<0.85	<0.85	<0.85
1,2,4-trichlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80
sec-butylbenzene *	ng/tube	0.8	<0.80	<0.80	<0.80
p-Isopropyltoluene (p-Cymene) *	ng/tube	0.8	<0.80	<0.80	<0.80
1,4-dichlorobenzene *	ng/tube	0.75	<0.75	<0.75	<0.75
n-butylbenzene *	ng/tube	2	<2.0	<2.0	<2.0
1,2-dichlorobenzene *	ng/tube	0.85	<0.85	<0.85	<0.85
1,2-dibromo-3-chloropropane *	ng/tube	0.85	<0.85	<0.85	<0.85
1,2,4-trimethylbenzene *	ng/tube	0.75	3.3	<0.75	9.4
Hexachlorobutadiene *	ng/tube	0.5	<0.50	<0.50	<0.50
Naphthalene *	ng/tube	0.5	<0.50	<0.50	<0.50
1,2,3-trichlorobenzene *	ng/tube	0.8	<0.80	<0.80	<0.80

METHOD SUMMARY

METHOD	METHOD SUMMARY
ME-AN-061	This method is used to determine Benzene, Toluene, Ethylebenzene & Xylene's in air samples which have been actively or passively sampled onto an adsorbent thermal desorption tube. The sample tubes are loaded onto the thermal desorption unit autosampler and the compounds are desorbed at 300°C for 7 minutes with a flow of Helium onto a cryo-focusing Tenax® trap. The trap is then quickly desorbed onto the analytical capillary column in the gas chromatograph which separates the compounds. Each compound is then identified and quantified by the mass spectrometer which is operated in full scan mode over a 50 – 300amu range. Identification of analytes is accomplished by comparing their mass spectra with the mass spectra of authentic standards and elution times. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve.

FOOTNOTES

IS	Insufficient sample for analysis.		-	The sample was not analysed for this analyte
LNR	Sample listed, but not received.		*	Results marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this laboratory / certification body / inspection body".
^	Performed by outside laboratory.			
LOR	Limit of Reporting			

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Unless otherwise indicated, samples were received in containers fit for purpose.

LAB-QLT-REP-001

Signed with Impression - Chain of Custody

Signature Request			
Signature Request ID:	602aecb6-c94a-4621-81aa-424104a5555a	Timestamp:	2022-10-20 14:04:40 GMT
Signee Name:	Tasneem Tagari	Sender Name:	Tasneem Tagari
Request Type:	WebSigning	Request Status:	WEBVIEWER SIGNED
Original Document			
Document Name:	JBX2212840_0000033189PDF.pdf	Document Size:	146.4 KB
Email Evidence			
Signee Email:	tt@xlab.earth	Email Subject:	Not available in Silent Mode
Email Sent Timestamp:	Not available in Silent Mode	Email Opened Timestamp:	Not available in Silent Mode
Web Evidence			
Signee IP Address:	41.79.81.146	Request Timestamp:	2022-10-20 14:04:02 GMT
Signee GPS (if shared):	ZA: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/106.0.0.0 Safari/537.36	Terms Accepted Timestamp:	2022-10-20 14:04:16 GMT
Annotations and Modifications			
Signature Count:	1	Form Fields Filled Count:	0
Text Annotation Count:	0	Initial All Pages Count:	0
Single Initial Count:	0		
Signing Evidence			
Signee Mobile:	+27834449137	Sign Type:	WebSigning
Security Challenge:	NONE	Part of Workflow:	NONE
Chain Of Custody Generation			
Attached Document Name:	20221020T140440.690954Z JBX2212840_0000033189PDF.pdf	Attached Timestamp:	2022-10-20 14:04:40 GMT

TEST REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Quentin Hurt	Laboratory	X-Lab Earth Science
Client	SKYSIDE (PTY) LTD	Address	2 Samantha Street, Strydompark, Randburg, 2169
Address	2 Samantha Street Strydompark Randburg	Telephone	+27 (0)11 590 3000
Telephone		Laboratory Manager	Mrs Tasneem Tagari
Facsimile		Lab Reference	JBX22-12883
Email		Report Number	0000048905
		Date Received	14/09/2022 15:03
Order Number	STR003	Date Started	19/09/2022 12:53
Samples	4	Date Reported	06/10/2022 14:11
Sample matrix	AIR		

The document is issued in accordance with SANAS's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. SANAS accredited laboratory T0775.

T0775

Samples received at ambient temp good condition.

SIGNATORIES

Tasneem Tagari

General Manager/Technical Signatory

Report number 0000048905

Client reference:

STR003

TEST REPORT

Parameter	Units	LOR	Sample Number / Sample Name	JBX22-12883.001 CH595-North	JBX22-12883.002 CH596-West	JBX22-12883.003 CH598-East	JBX22-12883.004 CH597-South

BTEX on Radiello RAD130

Benzene *	ug/tube	1	2.3	2.3	2.5	2.5
Toluene *	ug/tube	1	6.5	4.7	6.4	6.0
Ethylbenzene *	ug/tube	0.75	2.0	1.1	1.4	2.5
m/p-xylene *	ug/tube	0.8	3.8	2.8	3.6	5.4
o-xylene *	ug/tube	0.75	1.8	1.1	1.3	2.1

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061

Trichloromethane (Chloroform) *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane *	ug/tube	0.95	<0.95	<0.95	<0.95	<0.95
1,2-dichloroethane *	ug/tube	0.65	<0.65	<0.65	<0.65	<0.65
1,2-dichloropropane *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
Trichloroethene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
Dibromomethane *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
cis-1,3-dichloropropene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
trans-1,3-dichloropropene *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,1,2-trichloroethane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,3-dichloropropane *	ug/tube	0.65	<0.65	<0.65	<0.65	<0.65
Tetrachloroethene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
Bromodichloromethane *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,2-dibromoethane *	ug/tube	0.95	<0.95	<0.95	<0.95	<0.95
Chlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,1,1,2-tetrachloroethene *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
Carbon tetrachloride *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
Styrene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
Bromoform *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
Isopropylbenzene (Cumene) *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,1,2,2-tetrachloroethane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90

TEST REPORT

Parameter	Units	LOR	Sample Number: JBX22-12883.001 Sample Name: CH595-North	JBX22-12883.002 CH596-West	JBX22-12883.003 CH598-East	JBX22-12883.004 CH597-South

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061 (continued)

1,2,3-trichloropropane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
n-propylbenzene *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
Bromobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
2-chlorotoluene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,3,5-trimethylbenzene *	ug/tube	0.55	<0.55	<0.55	0.80	<0.55
4-chlorotoluene *	ug/tube	0.7	<0.70	<0.70	<0.70	<0.70
1,3-dichlorobenzene *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
tert-butylbenzene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trichlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
sec-butylbenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
p-Isopropyltoluene (p-Cymene) *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,4-dichlorobenzene *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
n-butylbenzene *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
1,2-dichlorobenzene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2-dibromo-3-chloropropane *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trimethylbenzene *	ug/tube	0.75	<0.75	2.1	3.2	<0.75
Hexachlorobutadiene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
Naphthalene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
1,2,3-trichlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80

METHOD SUMMARY

METHOD	METHOD SUMMARY
ME-AN-061	This method is used to determine Benzene, Toluene, Ethylebenzene & Xylene's in air samples which have been actively or passively sampled onto an adsorbent thermal desorption tube. The sample tubes are loaded onto the thermal desorption unit autosampler and the compounds are desorbed at 300ºC for 7 minutes with a flow of Helium onto a cryo-focusing Tenax® trap. The trap is then quickly desorbed onto the analytical capillary column in the gas chromatograph which separates the compounds. Each compound is then identified and quantified by the mass spectrometer which is operated in full scan mode over a 50 – 300amu range. Identification of analytes is accomplished by comparing their mass spectra with the mass spectra of authentic standards and elution times. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve.

FOOTNOTES

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
^	Performed by outside laboratory.
LOR	Limit of Reporting
-	The sample was not analysed for this analyte
*	Results marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this laboratory / certification body / inspection body".

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Unless otherwise indicated, samples were received in containers fit for purpose.

LAB-QLT-REP-001

Signed with Impression - Chain of Custody

Signature Request			
Signature Request ID:	dce58d27-68ff-43cc-8364-8e5ff9349c48	Timestamp:	2022-10-06 12:18:02 GMT
Signee Name:	Tasneem Tagari	Sender Name:	Tasneem Tagari
Request Type:	WebSigning	Request Status:	WEBVIEWER SIGNED
Original Document			
Document Name:	JBX2212883_0000033015PDF.pdf	Document Size:	141.3 KB
Email Evidence			
Signee Email:	tt@xlab.earth	Email Subject:	Not available in Silent Mode
Email Sent Timestamp:	Not available in Silent Mode	Email Opened Timestamp:	Not available in Silent Mode
Web Evidence			
Signee IP Address:	41.79.81.146	Request Timestamp:	2022-10-06 12:17:35 GMT
Signee GPS (if shared):	ZA: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/106.0.0.0 Safari/537.36	Terms Accepted Timestamp:	2022-10-06 12:17:50 GMT
Annotations and Modifications			
Signature Count:	1	Form Fields Filled Count:	0
Text Annotation Count:	0	Initial All Pages Count:	0
Single Initial Count:	0		
Signing Evidence			
Signee Mobile:	+27834449137	Sign Type:	WebSigning
Security Challenge:	NONE	Part of Workflow:	NONE
Chain Of Custody Generation			
Attached Document Name:	20221006T121802.287434Z JBX2212883_0000033015PDF.pdf	Attached Timestamp:	2022-10-06 12:18:02 GMT

AMENDED REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Quentin Hurt	Laboratory	X-Lab Earth Science
Client	SKYSIDE (PTY) LTD	Address	2 Samantha Street, Strydompark, Randburg, 2169
Address	2 Samantha Street Strydompark Randburg	Telephone	+27 (0)11 590 3000
Telephone		Laboratory Manager	Mrs Tasneem Tagari
Facsimile		Lab Reference	JBX22-12930 RO 01
Email		Report Number	0000049839
		Date Received	20/09/2022 15:18
Order Number	STR003	Date Started	6/10/2022 13:48
Samples	5	Date Reported	26/10/2022 13:53
Sample matrix	AIR		

The document is issued in accordance with SANAS's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. SANAS accredited laboratory T0775.

ilac-MRA sanas Testing Laboratory T0775

Samples received at ambient temp good condition.

This report cancels and supersedes Report No: 0000048907 issued by X-Lab Earth Science on 06/10/2022. The reason for re-issue is that the Client queried samples NO968-East and W555E-Blank, as results appear to have been swapped. Samples were rerun and it was determined that the samples had indeed been swapped by the analyst and the results were corrected accordingly.

SIGNATORIES

Tasneem Tagari

General Manager/Technical Signatory

TEST REPORT

Parameter	Units	LOR	Sample Number: JBX22-12930.001 Sample Name: NO969-North	JBX22-12930.002 NO971-West	JBX22-12930.003 NO968-East	JBX22-12930.004 NO970-South

BTEX on Radiello RAD130

Benzene *	ug/tube	1	7.5	1.5	6.5	<1.0
Toluene *	ug/tube	1	5.5	5.4	5.5	4.1
Ethylbenzene *	ug/tube	0.75	1.7	0.76	1.6	1.7
m/p-xylene *	ug/tube	0.8	6.1	2.9	5.9	4.7
o-xylene *	ug/tube	0.75	1.9	0.84	2.1	1.7

Volatile Organic Compounds (VOC) in Air Method: ME-AN-061

Trichloromethane (Chloroform) *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
1,1,1-trichloroethane *	ug/tube	0.95	<0.95	<0.95	<0.95	<0.95
1,2-dichloroethane *	ug/tube	0.65	<0.65	<0.65	<0.65	<0.65
1,2-dichloropropane *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
Trichloroethene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
Dibromomethane *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
cis-1,3-dichloropropene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
trans-1,3-dichloropropene *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,1,2-trichloroethane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
1,3-dichloropropane *	ug/tube	0.65	<0.65	<0.65	<0.65	<0.65
Tetrachloroethene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
Bromodichloromethane *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,2-dibromoethane *	ug/tube	0.95	<0.95	<0.95	<0.95	<0.95
Chlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,1,1,2-tetrachloroethene *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
Carbon tetrachloride *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
Styrene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
Bromoform *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
Isopropylbenzene (Cumene) *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
1,1,2,2-tetrachloroethane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90

TEST REPORT

Parameter	Units	Sample Number / Sample Name / LOR	JBX22-12930.001 NO969-North	JBX22-12930.002 NO971-West	JBX22-12930.003 NO968-East	JBX22-12930.004 NO970-South

Volatile Organic Compounds (VOC) in Air Method: ME-AN-061 (continued)

Parameter	Units	LOR	JBX22-12930.001	JBX22-12930.002	JBX22-12930.003	JBX22-12930.004
1,2,3-trichloropropane *	ug/tube	0.9	<0.90	<0.90	<0.90	<0.90
n-propylbenzene *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
Bromobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
2-chlorotoluene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,3,5-trimethylbenzene *	ug/tube	0.55	1.0	<0.55	<0.55	<0.55
4-chlorotoluene *	ug/tube	0.7	<0.70	<0.70	<0.70	<0.70
1,3-dichlorobenzene *	ug/tube	1	<1.0	<1.0	<1.0	<1.0
tert-butylbenzene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trichlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
sec-butylbenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
p-Isopropyltoluene (p-Cymene) *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80
1,4-dichlorobenzene *	ug/tube	0.75	<0.75	<0.75	<0.75	<0.75
n-butylbenzene *	ug/tube	2	<2.0	<2.0	<2.0	<2.0
1,2-dichlorobenzene *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2-dibromo-3-chloropropane *	ug/tube	0.85	<0.85	<0.85	<0.85	<0.85
1,2,4-trimethylbenzene *	ug/tube	0.75	1.1	<0.75	<0.75	0.98
Hexachlorobutadiene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
Naphthalene *	ug/tube	0.5	<0.50	<0.50	<0.50	<0.50
1,2,3-trichlorobenzene *	ug/tube	0.8	<0.80	<0.80	<0.80	<0.80

TEST REPORT

Parameter	Units	LOR	Sample Number: JBX22-12930.005 Sample Name: W555E BLANK

BTEX on Radiello RAD130

Parameter	Units	LOR	JBX22-12930.005
Benzene *	ug/tube	1	<1.0
Toluene *	ug/tube	1	<1.0
Ethylbenzene *	ug/tube	0.75	<0.75
m/p-xylene *	ug/tube	0.8	<0.80
o-xylene *	ug/tube	0.75	<0.75

Volatile Organic Compounds (VOC) in Air   Method: ME-AN-061

Parameter	Units	LOR	JBX22-12930.005
Trichloromethane (Chloroform) *	ug/tube	2	<2.0
1,1,1-trichloroethane *	ug/tube	0.95	<0.95
1,2-dichloroethane *	ug/tube	0.65	<0.65
1,2-dichloropropane *	ug/tube	0.85	<0.85
Trichloroethene *	ug/tube	0.5	<0.50
Dibromomethane *	ug/tube	0.8	<0.80
cis-1,3-dichloropropene *	ug/tube	0.8	<0.80
trans-1,3-dichloropropene *	ug/tube	0.9	<0.90
1,1,2-trichloroethane *	ug/tube	0.9	<0.90
1,3-dichloropropane *	ug/tube	0.65	<0.65
Tetrachloroethene *	ug/tube	0.8	<0.80
Bromodichloromethane *	ug/tube	1	<1.0
Dibromochloromethane *	ug/tube	0.75	<0.75
1,2-dibromoethane *	ug/tube	0.95	<0.95
Chlorobenzene *	ug/tube	0.8	<0.80
1,1,1,2-tetrachloroethene *	ug/tube	0.9	<0.90
Carbon tetrachloride *	ug/tube	1	<1.0
Styrene *	ug/tube	0.85	<0.85
Bromoform *	ug/tube	2	<2.0
Isopropylbenzene (Cumene) *	ug/tube	0.75	<0.75
1,1,2,2-tetrachloroethane *	ug/tube	0.9	<0.90

TEST REPORT

Parameter	Units	LOR	Sample Number: JBX22-12930.005 Sample Name: W555E BLANK

Volatile Organic Compounds (VOC) in Air Method: ME-AN-061 (continued)

1,2,3-trichloropropane *	ug/tube	0.9	<0.90
n-propylbenzene *	ug/tube	2	<2.0
Bromobenzene *	ug/tube	0.8	<0.80
2-chlorotoluene *	ug/tube	0.85	<0.85
1,3,5-trimethylbenzene *	ug/tube	0.55	1.1
4-chlorotoluene *	ug/tube	0.7	<0.70
1,3-dichlorobenzene *	ug/tube	1	<1.0
tert-butylbenzene *	ug/tube	0.85	<0.85
1,2,4-trichlorobenzene *	ug/tube	0.8	<0.80
sec-butylbenzene *	ug/tube	0.8	<0.80
p-Isopropyltoluene (p-Cymene) *	ug/tube	0.8	<0.80
1,4-dichlorobenzene *	ug/tube	0.75	<0.75
n-butylbenzene *	ug/tube	2	<2.0
1,2-dichlorobenzene *	ug/tube	0.85	<0.85
1,2-dibromo-3-chloropropane *	ug/tube	0.85	<0.85
1,2,4-trimethylbenzene *	ug/tube	0.75	0.98
Hexachlorobutadiene *	ug/tube	0.5	<0.50
Naphthalene *	ug/tube	0.5	<0.50
1,2,3-trichlorobenzene *	ug/tube	0.8	<0.80

METHOD SUMMARY

METHOD	METHOD SUMMARY
ME-AN-061	This method is used to determine Benzene, Toluene, Ethylebenzene & Xylene's in air samples which have been actively or passively sampled onto an adsorbent thermal desorption tube. The sample tubes are loaded onto the thermal desorption unit autosampler and the compounds are desorbed at 300ºC for 7 minutes with a flow of Helium onto a cryo-focusing Tenax® trap. The trap is then quickly desorbed onto the analytical capillary column in the gas chromatograph which separates the compounds. Each compound is then identified and quantified by the mass spectrometer which is operated in full scan mode over a 50 – 300amu range. Identification of analytes is accomplished by comparing their mass spectra with the mass spectra of authentic standards and elution times. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using an appropriate calibration curve.

FOOTNOTES

IS	Insufficient sample for analysis.	-	The sample was not analysed for this analyte
LNR	Sample listed, but not received.	*	Results marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this laboratory / certification body / inspection body".
^	Performed by outside laboratory.		
LOR	Limit of Reporting		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Unless otherwise indicated, samples were received in containers fit for purpose.

LAB-QLT-REP-001

Signed with Impression - Chain of Custody

Signature Request			
Signature Request ID:	082a491d-eaa1-4678-97e6-93ccda0e99b8	Timestamp:	2022-10-26 11:55:29 GMT
Signee Name:	Tasneem Tagari	Sender Name:	Tasneem Tagari
Request Type:	WebSigning	Request Status:	WEBVIEWER SIGNED
Original Document			
Document Name:	JBX2212930_0000033409PDF.pdf	Document Size:	146.1 KB
Email Evidence			
Signee Email:	tt@xlab.earth	Email Subject:	Not available in Silent Mode
Email Sent Timestamp:	Not available in Silent Mode	Email Opened Timestamp:	Not available in Silent Mode
Web Evidence			
Signee IP Address:	41.79.81.146	Request Timestamp:	2022-10-26 11:54:55 GMT
Signee GPS (if shared):	ZA: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/106.0.0.0 Safari/537.36	Terms Accepted Timestamp:	2022-10-26 11:55:10 GMT
Annotations and Modifications			
Signature Count:	1	Form Fields Filled Count:	0
Text Annotation Count:	0	Initial All Pages Count:	0
Single Initial Count:	0		
Signing Evidence			
Signee Mobile:	+27834449137	Sign Type:	WebSigning
Security Challenge:	NONE	Part of Workflow:	NONE
Chain Of Custody Generation			
Attached Document Name:	20221026T115529.703887Z JBX2212930_0000033409PDF.pdf	Attached Timestamp:	2022-10-26 11:55:29 GMT